Vanessa LoBue · Koraly Pérez-Edgar
Kristin A. Buss *Editors*

Handbook of Emotional Development

Springer

Handbook of Emotional Development

Vanessa LoBue • Koraly Pérez-Edgar
Kristin A. Buss
Editors

Handbook of Emotional Development

Springer

Editors
Vanessa LoBue
Department of Psychology
Rutgers University—Newark
Newark, NJ, USA

Koraly Pérez-Edgar
Department of Psychology
Pennsylvania State University
University Park, PA, USA

Kristin A. Buss
Department of Psychology
The Pennsylvania State University
University Park, PA, USA

ISBN 978-3-030-17331-9 ISBN 978-3-030-17332-6 (eBook)
https://doi.org/10.1007/978-3-030-17332-6

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

To my love, Scott, who believes in me like no other and reminds me to enjoy the little things. To my boys, Will and Charlie, who have given me the gift of motherhood and the privilege of looking forward to the future. I'd like to also acknowledge my brilliant colleagues, Koraly and Vanessa, without whom I'd be lost in my own academic world.

– Kristin A. Buss

To my mentors, Judy and Karen, who taught me how to think about emotional development, and to my family, who patiently guided me through my own.

– Vanessa LoBue

To my children, who have taught me from day one that a degree in developmental psychology will only take you so far in the realm of parenting. Their inspiration keeps me moving forward, fueling any and all successes.

– Koraly Pérez-Edgar

Acknowledgments

We'd like to thank the authors of this volume for contributing the time and effort to highlighting the thoughtful and insightful work that makes up the field of emotional development. We'd also like to thank the hundreds of families who have dedicated countless hours to building the science reflected in this work.

Contents

Part IV Atypical Emotional Development

Contributors

Erinn L. Acland Department of Psychology, University of Toronto Mississauga, Toronto, ON, Canada

Yeojin Amy Ahn University of Miami, Department of Psychology, Miami, FL, USA

Joseph P. Allen University of Virginia, Charlottesville, VA, USA

Mairin Augustine University of North Carolina at Chapel Hill, Center for Developmental Science, Chapel Hill, NC, USA

Lauren G. Bailes The University of North Carolina at Greensboro, Greensboro, NC, USA

Sarah R. Bardack Imagine Worldwide, San Francisco, CA, USA

Laurie Bayet American University, Department of Psychology, Washington, DC, USA

Martha Ann Bell Virginia Tech, Department of Psychology, Blacksburg, VA, USA

Jessica L. Burris Rutgers University—Newark, Department of Psychology, Newark, NJ, USA

Tawny R. Bussey Center for Mind and Brain, University of California, Davis, CA, USA

Kristin A. Buss The Pennsylvania State University, Department of Psychology, University Park, PA, USA

Susan D. Calkins University of North Carolina—Greensboro, Department of Human Development and Family Studies, Greensboro, NC, USA

Margaret Cameron College of William and Mary, Department of Psychological Sciences, Williamsburg, VA, USA

Linda A. Camras Depaul University, Chicago, IL, USA

Mariya Chernenok Human Development Graduate Group and the Center for Mind and Brain, University of California—Davis, Davis, CA, USA

Dante Cicchetti Institute of Child Development, University of Minnesota, Minneapolis, MN, USA

Sarah J. Coe-Odess University of Virginia, Charlottesville, VA, USA

Pamela M. Cole The Pennsylvania State University, Department of Psychology, University Park, PA, USA

Jasmine DeJesus University of North Carolina at Greensboro, Department of Psychology, Greensboro, NC, USA

Mauricio Delgado Rutgers University—Newark, Department of Psychology, Newark, NJ, USA

Susanne A. Denham George Mason University, Department of Psychology, Fairfax, VA, USA

Anjolii Diaz Ball State University, Department of Psychological Science, Muncie, IN, USA

Jessica M. Dollar University of North Carolina—Greensboro, Department of Human Development and Family Studies, Greensboro, NC, USA

Nancy Eisenberg Arizona State University, Department of Psychology, Tempe, AZ, USA

Nathan A. Fox University of Maryland—College Park, Department of Human Development and Quantitative Methodology, College Park, MD, USA

Heather Greenebaum University of Pennsylvania, School of Social Policy and Practice, Philadelphia, PA, USA

Megan R. Gunnar Institute of Child Development, University of Minnesota, Minneapolis, MN, USA

Madeline B. Harms University of Wisconsin—Madison, Department of Psychology, Madison, WI, USA

Paul L. Harris Harvard University, Cambridge, MA, USA

Paul D. Hastings University of California—Davis, Department of Psychology, Davis, CA, USA

Sarah Kahle University of California Davis School of Medicine, Department of Psychiatry and Behavioral Sciences, Sacramento, CA, USA

Anne E. Kalomiris Department of Psychology, Miami University, Oxford, OH, USA

Elizabeth J. Kiel Department of Psychology, Miami University, Oxford, OH, USA

Emily Kim Rutgers University—Newark, Department of Psychology, Newark, NJ, USA

Shreya Lakhan-Pal Institute of Child Development, University of Minnesota, Minneapolis, MN, USA

Esther M. Leerkes The University of North Carolina at Greensboro, Greensboro, NC, USA

Brian T. Leitzke University of Wisconsin—Madison, Department of Psychology, Madison, WI, USA

Michael Lewis Rutgers Robert Wood Johnson Medical School, Department of Pediatrics, Institute for the Study of Child Development, New Brunswick, NJ, USA

Kristen A. Lindquist University of North Carolina—Chapel Hill, Department of Psychology and Neuroscience, Chapel Hill, NC, USA

Ran Liu Virginia Tech, Department of Psychology, Blacksburg, VA, USA

Vanessa LoBue Rutgers University—Newark, Department of Psychology, Newark, NJ, USA

Tina Malti Department of Psychiatry and Psychology, University of Toronto, Toronto, ON, Canada

Daniel Messinger University of Miami, Department of Psychology, Miami, FL, USA

Samantha G. Mitsven University of Miami, Department of Psychology, Miami, FL, USA

Santiago Morales University of Maryland—College Park, Department of Human Development and Quantitative Methodology, College Park, MD, USA

Eleanor Myatt Department of Psychology, University of Toronto Mississauga, Toronto, ON, Canada

Rachel K. Narr University of Virginia, Charlottesville, VA, USA

Charles A. Nelson Harvard University, Harvard Medical School and Boston Children's Hospital, Harvard Graduate School of Education, Cambridge, MA, USA

Alyssa R. Palmer Institute of Child Development, University of Minnesota, Minneapolis, MN, USA

Joanna Peplak Department of Psychology, University of Toronto Mississauga, Toronto, ON, Canada

Koraly Pérez-Edgar The Pennsylvania State University, Department of Psychology, University Park, PA, USA

Nicole B. Perry Institute of Child Development, University of Minnesota, Minneapolis, MN, USA

Seth D. Pollak University of Wisconsin—Madison, Department of Psychology, Madison, WI, USA

Francisco Pons University of Oslo, Oslo, Norway

Natalee Price Miami University of Ohio, Department of Psychology, Oxford, OH, USA

Emily B. Prince University of Miami, Department of Psychology, Miami, FL, USA

Susan M. Rivera University of California—Davis, Department of Psychology and the Center for Mind and Brain, Davis, CA, USA

Camila Rivero-Fernández University of Miami, Department of Psychology, Miami, FL, USA

Joshua Rottman Franklin and Marshall College, Department of Psychology, Lancaster, PA, USA

Holly Shablack University of North Carolina—Chapel Hill, Department of Psychology and Neuroscience, Chapel Hill, NC, USA

Tracy L. Spinrad Arizona State University, T. Denny Sanford School of Social and Family Dynamics, Tempe, AZ, USA

Cynthia Stifter The Pennsylvania State University, Department of Human Development and Family Studies, University Park, PA, USA

Lei Sun University of Miami, Department of Psychology, Miami, FL, USA

Qi Wang Department of Human Development, Cornell University, Ithaca, NY, USA

Sherri C. Widen Committee for Children, Seattle, WA, USA

Christy D. Wolfe Bellarmine University, Department of Psychology, Louisville, KY, USA

Yang Yang Centre for Research in Child Development, National Institute of Education, Singapore, Singapore

Janice Zeman College of William and Mary, Department of Psychological Sciences, Williamsburg, VA, USA

Linlin Zhang Department of Psychology, University of Toronto Mississauga, Toronto, ON, Canada

Anna M. Zhou The Pennsylvania State University, Department of Psychology, University Park, PA, USA

About the Editors

Vanessa LoBue, PhD is an Associate Professor of Psychology at Rutgers University. She received her B.S. from Carnegie Mellon University and her M.A. and Ph.D. from the University of Virginia. Dr. LoBue's research focuses on human behavioral responses to emotionally valenced stimuli—specifically to negative or threatening stimuli—and the mechanisms guiding the development of these responses. More specifically, she examines how early perceptual biases for threat contribute to maladaptive avoidance behaviors, such as those associated with the development of fear and anxiety, and how cognition contributes to children's learning of adaptive avoidance responses, such as avoidance of contagious people or contaminated objects.

Koraly Pérez-Edgar, PhD is the McCourtney Professor of Child Studies and a Professor of Psychology at the Pennsylvania State University. She received her A.B. from Dartmouth College and Ph.D. from Harvard University. Dr. Pérez-Edgar's research focuses on the relations between temperament and psychopathology. In particular, she examines how individual differences in attention can work to ameliorate or exacerbate risks associated with early temperament traits. She is a Fellow of the Association for Psychological Science.

Kristin A. Buss, PhD is a Professor of Psychology and Human Development and Family Studies at the Pennsylvania State University. She received her B.S. from the University of Minnesota and her M.S. and Ph.D. from the University of Wisconsin. Dr. Buss' research focuses on understanding the temperamental factors and emotional processes—reactivity and regulation—that account for the development of social anxiety problems across development. In particular, her work focuses on early-appearing fear dysregulation as a specific marker of increased risk for social anxiety disorder symptoms across childhood into adolescence.

Introduction: Emotional Development, Past, and Present

Vanessa LoBue, Koraly Pérez-Edgar, and Kristin A. Buss

Abstract

In the Introduction to the volume, we present a brief history of emotion research and how research on emotional development differentiates itself from the broader emotion literature.

In 1884, William James wrote an essay that posed an important question: *What is an emotion*? It is a question that has fascinated philosophers and scientists for centuries before James' time. In the essay, James argued that emotions have a physiological basis--a response to Charles Darwin's published book, *The Expression of Emotions in Men and Animals* (1872), which posited that through natural selection, humans and animals evolved a shared set of traits and include emotional responses. These early works set the stage for the classic discrete emotions perspective, which suggests that emotions are biologically based, universally distinguishable, and cause a narrow set of stereotyped responses (e.g., Ekman & Cordaro, 2011; Ekman & Keltner, 1970; Izard, 1993, 2007). This view was contrasted by appraisal perspectives which first gained traction in the 1960s (Arnold, 1960; Clore & Ortony, 2008; Lazarus, 1984) and then by modern constructivist perspectives (e.g., Barrett, 2006; Cunningham, Dunfield, & Stillman, 2013), both of which highlight the important roles of cognition and context in emotional responding. According to these perspectives, emotions *emerge* from the conscious experience of a confluence of physiological and behavioral responses to an event (e.g., Barrett, 2006; Coan, 2010).

The field of emotion research has not yet agreed on an answer to James' classic question, but these varying emotion theories that first began to take form in the late 1800s have now shaped over a century of scientific research. This research has not only attempted to answer James' question about *what* an emotion is (e.g., whether it is a natural kind or a multi-component system), but it has also attempted to answer the question of *where* an emotion is (e.g., whether they are distinctly represented in the brain or whether they are conscious feelings that emerge from a variety of lower-level processes), *why* we have emotions at all (e.g., whether they evolved to help humans cope with a unique problem in the environment or whether they are the result of a combination of more general physiological and cognitive processes), and *how* emotions are related to other cognitive and behavioral processes.

V. LoBue (✉)
Rutgers University—Newark, Department of Psychology, Newark, NJ, USA
e-mail: vlobue@psychology.rutgers.edu

K. Pérez-Edgar · K. A. Buss
The Pennsylvania State University, Department of Psychology, University Park, PA, USA

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_1

These questions are crucially important to our understanding of human emotion. However, what is notably absent from this set of questions are two core issues: *When* do emotions emerge in development, and *for whom* are they most likely to emerge? These questions may not be in the forefront of the minds of social and cognitive psychologists, but they are critical to researchers interested in *emotional development*. Emotional development is generally seen as a small subset of the larger field of emotion research. Indeed, in the most prominent emotion compendiums such as the *Handbook of Emotions* or the *Handbook of Affective Sciences*, development is covered as a subset in one of several larger sections. However, despite having some small real estate in these larger handbooks, researchers who study emotional development approach it from a variety of perspectives and methodologies that are unique to developmental science.

The empirical study of emotional development perhaps started in the 1960s, when John Bowlby and Mary Ainsworth began an investigation of the effects of maternal separation on child development. In her classic "strange situation" paradigm, Ainsworth tried to measure infants' emotional responses to maternal separation in and out of the presence of a stranger in order to describe their attachment style (Ainsworth & Bell, 1970). Around the same time, Jerome Kagan was also studying emotional responses in infants (Kagan, Moss, & Kagan, 1962). However, he was interested in using their emotional responses to both novel objects and people to identify infant temperament—or an individual's own style of emotional responding—and how it predicted their behavior in social situations. Both Ainsworth's and Kagan's approaches to studying emotions in infants and children differed significantly from those of their contemporaries who were studying emotion in adults. Instead of asking what emotions are, they focused on individual differences in emotional responding and how those individual differences predicted other important behaviors like attachment quality or sociability over the course of development.

In keeping with this initial line of work, contemporary developmental psychologists who study emotion still take a very different approach when compared to social and cognitive psychologists and neuroscientists who mainly focus on adults. Specially, while developmentalists ask the *what*, *where*, *why*, and *how* questions of emotion, they are also interested in *when* emotions develop throughout the lifespan and often take a person-centered approach—the question of *who*—to ask how individual differences in emotional responding predict other behaviors. Along with a unique set of questions, developmental psychologists approach emotion with a unique set of methods that are especially tailored to younger participants. Unlike typical adults, infants and young children are either non-verbal or have limited language abilities, they are notoriously noncompliant, relatively incapable of following lengthy instructions, and typically do not maintain the relatively sedate state needed to provide neural measures (e.g., fMRI). Thus, developmentalists often have to rely on a unique set of methodologies, such as passive viewing attention measures, eye-tracking, gross behavioral responses, physiology, EEG/ERP, and parent report.

Further, although many developmentalists use either discrete emotions or emergent frameworks in their work, others use one of two developmental approaches to guide their methodologies and research questions. Many, for example, take a functionalist perspective on emotional development, which is a process-based approach that focuses on the adaptive function that each emotion serves. Others take a dynamic systems approach, which focuses on describing the process by which emotions emerge across development based on context and individual differences (for a review of both perspectives, see Witherington & Crichton, 2007). Although the discrete versus emergent debate resonates loudly in the emotion literature more broadly, it is clear from the chapters that follow that the functionalist and dynamic systems perspectives are more dominant in the developmental literature.

Altogether, while emotional development is indeed a subfield of emotion research, it is also a unique, burgeoning field of its own, with distinct theoretical frameworks, methodologies, and empirical questions. This is the first handbook that

focuses on emotional development specifically, highlighting its unique and important place in the broader emotion literature. The chapters that follow are organized to reflect some of the broader themes present in the emotion literature, most of which are touched upon above. Part I addresses the theoretical and biological foundations of emotional development, with chapters on theories of emotional development, the physiology and neuroscience of emotional development, the expression and perception of emotional facial expressions, and temperament. Part II addresses research on individual (or discrete) emotions, including happiness, anger, sadness, fear, disgust, and the self-conscious and pro-social emotions. Part III focuses on the roles of cognition and context on emotional development, with chapters on cognition, emotion regulation, theory of mind, language, education, emotional competence, morality, culture, adolescence, and family. Finally, Part IV presents atypical emotional development, including chapters on anxiety, depression, developmental disorders, maltreatment, and deprivation.

References

Ainsworth, M. D. S., & Bell, S. M. (1970). Attachment, exploration, and separation: Illustrated by the behavior of one-year-olds in a strange situation. *Child Development, 41*, 49–67.

Arnold, M. B. (1960). *Emotion and personality*. New York, NY: Columbia University Press.

Barrett, L. F. (2006). Are emotions natural kinds? *Perspectives on Psychological Science, 1*, 28–58.

Clore, G. L., & Ortony, A. (2008). Appraisal theories: How cognition shapes affect into emotion. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 628–642). New York, NY: Guilford Press.

Coan, J. A. (2010). Emergent ghosts of the emotion machine. *Emotion Review, 2*, 274–285.

Cunningham, W. A., Dunfield, K. A., & Stillman, P. E. (2013). Emotional states from affective dynamics. *Emotion Review, 5*, 344–355.

Darwin, C. (1872). *The expression of the emotions in man and animals*. London, UK: John Murray.

Ekman, P., & Cordaro, D. (2011). What is meant by calling emotions basic. *Emotion Review, 3*, 364–370.

Ekman, P., & Keltner, D. (1970). Universal facial expressions of emotion. *California Mental Health Research Digest, 8*, 151–158.

Izard, C. E. (1993). Organizational and motivational functions of discrete emotions. In M. Lewis & J. M. Haviland (Eds.), *Handbook of emotions* (pp. 631–641). New York, NY: Guilford Press.

Izard, C. E. (2007). Basic emotions, natural kinds, emotion schemas, and a new paradigm. *Perspectives on Psychological Science, 2*, 260–280.

James, W. (1884). What is an emotion? *Mind, 9*, 188–205.

Kagan, J., Moss, H. A., & Kagan, S. (1962). *Birth to maturity: A study in psychological development*. New Haven, CT: Yale University Press.

Lazarus, R. S. (1984). On the primacy of cognition. *American Psychologist, 39*, 124–129.

Witherington, D. C., & Crichton, J. A. (2007). Frameworks for understanding emotions and their development: Functionalist and dynamic systems approaches. *Emotion, 7*, 628–637.

Part I

Theories and Biological Foundations of Emotional Development

Theories of Emotional Development: Where Have We Been and Where Are We Now?

Kristin A. Buss, Pamela M. Cole, and Anna M. Zhou

Abstract

In this chapter, we review several theories of emotional development. For each, we address definitions and basic tenets, we ask what "develops" and how emotions change with age. What is particularly noteworthy is that although there are several emotional development theories, none ascribes to a single emotion theory. Moreover, no single emotional development theory guides contemporary research. In the second half of the chapter, we review other conceptual frameworks and theories that are not emotion theories per se but are widely used to guide research on emotional development. Throughout this chapter, we provide illustrative empirical examples for aspects of each theory. In many ways, this chapter is a primer on emotion development theory rather than an exhaustive review of each theory. We end with a recommendation calling for empirical evidence to guide theory development.

Chances are if you're reading this handbook, you are interested in studying emotions in some way in your research. Perhaps you have read deeply and widely, thought about emotion in every aspect of the work that you do. Yet, if you're like many, you struggle to come up with completely satisfactory answers to "what is emotion" and "what is emotional development." You, like many others, may have an eclectic theoretical orientation, using bits and pieces of different theories to guide your conceptualizations, generate hypotheses, and design your studies.

Like many other domains of study of human behavior, there are an abundant number of theories of emotion, addressing the nature of emotion and distinctions between emotion and other related phenomena (e.g., mood, motivation, personality). In fact, a quick glance at the tables of contents of the last two Handbook of Emotion volumes (Barrett, Lewis, & Haviland-Jones, 2018; Lewis, Haviland-Jones, & Barrett, 2008), or of the Nature of Emotions volumes (1994, 2018), reveals the plethora of theories. Most of these theories, however, are in subdisciplines that

We wish to thank Kathleen Cracknell who provided critical support with library research for this chapter and Stephanie Culotta who assisted with collecting and organizing references. Kristin A. Buss was supported by the following grants from National Institute of Health, R01MH109692 and R01MH115974, and funding from the Social Science Research Institute at Pennsylvania State University in the writing of this chapter. Pamela M. Cole was supported by the following grants from the National Institutes of Health, R01MH61388 and R01HD076994. Anna Zhou was supported by an Enhanced Graduate Scholarship from the College of the Liberal Arts at Pennsylvania State University.

K. A. Buss (✉) · P. M. Cole · A. M. Zhou
The Pennsylvania State University, Department of Psychology, University Park, PA, USA
e-mail: kab37@psu.edu

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_2

focus on adult functioning. As a result, they focus on emotional phenomena in more fully developed forms; they conceptualize emotional behaviors, expressions, and thoughts from the vantage point of adult functioning and thereby lack any discussion of developmental etiology of those phenomena.

Yet, as students of human development, we understand that a downward extension of theories based on adult functioning is a less than satisfying way to explain emotional development across the life span. For example, many emotion theories center on conscious aspects of emotional experience (i.e., feelings). Many theories focus on two important aspects of emotional functioning—i.e., being aware of feelings and being able to reappraise them. However, we do not yet know how emotional awareness and appraisal processes develop. We assume they are not in the repertoire of infants and that they therefore develop with age. We seek theoretical models of emotional development that include the whole life span that have the long, prospective view that helps us understand when and how infants and young children function in ways that are similar to adults and how aspects of emotional functioning earlier in life differ from adult functioning and how and why those changes occur. Most theories, therefore, are limited in their ability to address development in their conceptualizations of emotion.

There is no unifying theory of emotional development. There are several emotional development theories, none of which ascribes to a single view of the nature of emotion; no single emotional development theory guides contemporary research. In fact, much of the published evidence is descriptive and often either is not guided by hypotheses of an explicit theory or cites a theory but does not explicitly test the theory. Indeed, the study of emotional development by many leading scholars borrows from different theories to generate questions that can be pursued from a developmental perspective. As we prepared to write this chapter, we wondered what theories guide the scholars contributing to this handbook volume. We asked each scholar the following questions: (1) What emotion theory (if any) do you ascribe to? (2) What theory of emotional development do you ascribe to? The results of this informal poll clearly indicated that this volume's authors do not adhere to a single guiding theory of emotional development. Rather, most draw from multiple theories—namely, differential emotion theory (Izard, 1971; Tomkins, 1962), emotion differentiation theory (Bridges, 1932; Sroufe, 1996), functionalist theory (Barrett & Campos, 1987; Campos & Barrett, 1984), and the dynamic differentiation model (Camras, 2011).

In this chapter, we review the prevailing theoretical frameworks that guide much of the developmental literature. For each, we first address how the theory conceptualizes emotion and then how it conceptualizes how emotion changes with age. We do not attempt to contrast or critique theories because each makes contributions to contemporary research. Instead, we offer a summary of each framework's basic tenets. We include discussion of a dominant debate in the emotion literature, specifically the debate about the extent to which humans have a set of basic, discrete emotions that evolved over the millennia and entail biological readiness to experience and express these emotions very early in life versus the extent to which distinct emotions are not biologically prepared but entail interpretations of more general arousal and valence experience that is later specified at a higher level of psychological processing, e.g., conceptually, due in large part to the human capacity for language. The last section of the chapter covers the application of emotion to other aspects of development—that is, how are emotional processes studied across development. Here, we pay particular attention to individual differences in emotional processes that shape trajectories of development from infancy through adolescence.

Theories of Emotion Development

Discrete/Differential Emotion Theory

Discrete/Basic View of Emotions

This theoretical approach draws from the evolutionary perspective of Darwin (1872, 2009) and

the James-Lange theory of emotion (Cannon, 1927; Lang, 1994) and includes both biological and social determinants of emotional development. It contends that humans are endowed with the capacity for a basic set of universal emotions that evolved as humans adapted to the circumstances of their lives. The emotions are basic in the sense that all humans are prepared to experience and express them (although they may emerge at different points in development and can vary to some degree across individuals, situations, and cultures) and each comprises differentiable, distinct features, e.g., facial expressions, physiological patterns, and subjective feelings. These models assume that evolution has led to physiological patterns that are spontaneous and automatic, although manageable in terms of how we choose to think about, express, and act upon them. They share the view that emotions require perception and appraisal, so recruit cognition, but they are not the product of a higher-order cognitive or linguistic process, which would reduce their automaticity and adaptive advantage.

The number of emotions in the basic set varies among different versions of this general premise. Tomkins (1962, Tomkins and McCarter 1964) an early proponent of this theoretical perspective, posited that there are nine "affect" systems, such as interest-excitement, distress-anguish, and anger-rage. Izard (1971, 1977) and Ekman (e.g., Ekman & Cordaro, 2011), both of whom consulted with Tomkins, posited ten and seven basic emotions or emotion families, respectively. Each of these sets includes happiness, anger, fear, surprise, sadness, and disgust. This perspective contends that the basic nature of these emotions leads to universal emotion expressions. Izard and Ekman's consultations with Tomkins led each to develop a method for inferring different emotions based on their unique configurations of facial activity. Ekman detailed the appearance changes associated with the contraction of each muscle and muscle combinations in the face. He then investigated which appearance changes were reliably associated with felt and perceived emotion (Ekman, Freisen, & Ancoli, 1980), which resulted in the Facial Action Coding System (Ekman & Friesen, 1978).

Two separate cross-cultural studies conducted in the early 1970s—one by Paul Ekman (Ekman & Friesen, 1971) and the other by Carroll Izard (1971)—demonstrated the universality of a set of basic emotional expressions, when expressed spontaneously. At the same time, they and others found evidence for cultural differences in emotional expressions. Ekman and Freisen (1969), for example, referred to display rules that are voluntary, learned principles, socialized by cultural values, that dictate whether one conveys emotion in the face (e.g., boys don't cry). Although facial expressions, according to Ekman (1977), are central elements of emotions and not merely expressions of feeling states, the face is not the only way emotions are differentiated—e.g., one view is that the voice may also provide differentiable emotional tones (e.g., Scherer, 1986, 2003). Emotions are distinct because each serves unique adaptive functions, a tenet shared by other emotion theories (e.g., functionalist perspective). Specifically, emotions organize and ready the individual for action, and expressions serve as signals that can be perceived by others, making emotion inherently social in nature. Ekman's and Izard's works on facial coding provided, for the first time, the opportunity to study emotions without inherent tautology (e.g., if someone is smiling the person is happy) and to do so earlier in development, moving forward the study of emotional development.

Decades of research provides some support for the theory that emotions are fundamentally discrete states (e.g., anger vs. fear vs. sadness). This evidence, however, is not without its critics, in particular, because of the evidence that different measures of emotions do not always cohere and that there is overlap across emotions. That is, there is no robust evidence for specificity of each discrete emotion (Barrett, 2006, 2011; Russell, 2003). Core affect theory conceptualizes different emotions as products of conceptual processing of basic reactions that vary on two continua: from displeasure to pleasure (valence) and from low to high arousal (Russell, 2003). The differentiation of these states arises from the fact that we are capable to conceptualizing and labeling experiences that vary in valence and

arousal (Barrett, Lindquist, & Gendron, 2007; Barrett, Mesquita, & Gendron, 2011; Russell, 2009). This fascinating debate between discrete and core affect approaches is worthy of a chapter of its own and has been addressed thoroughly in already published works, including representation in two chapters in this handbook (Shablack and Lindquist, Chap. 18, this volume; Widen, Chap. 19, this volume).

Discrete/Basic Emotion Perspective on Emotional Development

Only Izard developed a formal emotional development theory based on the premise of biologically based capacity for discrete emotions early in life (Izard, 1971, 1977). Izard, who first studied emotion expression in adults, later studied infants, which informed his theory of emotional development (Cole & Moore, 2015). Izard posited ten basic emotion systems, each of which is unique in how it motivates action and is experienced. He defined an emotion as a specific pattern of neural activity sending efferent signals to the body's periphery, stimulating neurohormonal activity, muscular readiness to express or behave, and experience, which may become but need not become conscious. Although he placed emphasis on the role of the environment in emotional development, Izard's conceptualization of emotion emphasized the self-organizing nature of biological systems that are sensitive to changes in the environment, both the external world around the person and the internal world. In DET, emotions serve the function of organizing behaviors around adaptive goals. Emotions are due to neurobiological processes that lead to expressive behaviors and corresponding feelings (Ackerman, Abe, & Izard, 1998). Izard posits that there are independent and dependent emotion systems, and these systems have different developmental trajectories (Izard, 2007; Izard & Abe, 2004).

Basic emotions are defined as natural kinds of emotions that do not depend on cognitive development for activation and are universal across all humans (Ackerman et al., 1998). These emotions, such as joy, sadness, and anger, are discrete and distinguishable, and each emotion is associated with specific facial expressions (Ackerman et al., 1998; Camras & Fatani, 2008; Izard, 2007). Basic emotions appear early in infancy as a function of maturation of neural circuits, and they remain stable across early development (Ackerman et al., 1998). For example, interest, joy, anger, and sadness emerge from around 2 months and remain stable through to 9 months of age (Izard, Fantauzzo, Castle, Haynes, et al., 1995). As a result, emotions are often measured using infants' and children's facial expressions as each emotion has a specific set of responses that are unique from other emotions.

On the other hand, emotions such as guilt and shame are categorized as dependent emotions, or emotion schemas (Ackerman et al., 1998; Izard, 2007). These are emotions that are dependent on interactions between affective and cognitive processes and cannot operate without appraisals and theory of mind (Ackerman et al., 1998). Basic emotions may become part of the schemas as emotion and related cognition interact (Izard, 2007). The emergence of the dependent emotions is influenced by experience, learning, and socialization during development. Emotions such as guilt and shame often emerge during the late-toddler/early childhood ages, corresponding with maturation of socio-cognitive structures.

In summary, DET proposes that there are a set of discrete, basic emotions that are universal and are served by hardwired biological structures. This core set of emotions then interact with cognitive systems to form emotion schemas that are more complex emotions that arise due to appraisals. From this perspective, the interactions between emotion and cognitive systems form normative emotional development, and deviations from typical interactions between these systems lead to atypical trajectories such as the development of internalizing and externalizing behaviors (Ackerman et al., 1998).

Functionalist Theory

Our informal poll of this volume's chapter authors revealed that most consider the

functionalist perspective on emotional development guides their thinking to some degree. Given its importance to contemporary research on emotional development, we first summarize the functionalist view of emotions and then discuss its application to emotional development.

Functionalist View of Emotion

The functionalist view of emotions emphasizes why we have emotions, and not just what emotions are, underscoring their functionality for adapting to circumstances (e.g., Ekman, 1992; Johnson-Laird & Oatley, 1992; Keltner & Gross, 1999; Lazarus, 1991). This perspective represented a fundamental shift in the scientific approach to understanding emotion. The functionalist perspective diverged from the definitional emphasis on the structure of an intrapsychic state and conceptualized emotion as a *goal-oriented psychological process that served adaptation goals* (Lazarus, 1991). This conceptualization was not entirely new; it had roots in Darwin's (1872) evolutionary perspective. Darwin emphasized the role of emotion in serving survival goals, such as protection from threat, overcoming obstacles to achieving goals, and communicating with others to serve the social effort to achieve the group's goals.

The functionalist view had overlap with discrete or differential emotion theories in that different emotions serve specific goals (Frijda, 1986). How a functional perspective differs from those theories is that it defines emotions in terms of the *relation* between the person and the environment in terms of those goals and not by an emotion isolated from its context. That is, emotions do not reside in individuals but are located in the relation between the person and the circumstances the person perceives.

Building on the work of Arnold (1960), the functional perspective considers each emotion as reflecting a particular appraisal-action readiness stance. In general, emotion enables a very rapid form of information processing that entails (1) appraising circumstances relative to goals and (2) readying to act in particular ways to attain, regain, maintain, or relinquish goals. In terms of specific emotions (Frijda, 1986), appraisal that a goal is blocked and readiness to act with increased effort to overcome the obstacle define anger. Appraisal that a goal is lost and readiness to relinquish attempts to regain it define sadness. Appraisal that a goal for well-being is threatened and readiness to withdraw or escape the threat define fear. Appraisal of anticipation or accomplishment of a goal for well-being and readiness to attain or maintain it define joy or happiness. The psychological process of emotion is, in essence, a rapid radar-and-response system that continually adjusts our relation to the environment, and with a range of options, enabling us to act quickly on our own behalf when necessary.

Functionalist Perspective on Emotional Development

A leading model of children's emotional development, which grew out of research on infant development, adopted the functionalist perspective of emotion (Campos & Barrett, 1984; Campos, Campos, & Barrett, 1989). It is noteworthy that this model emerged in the context of research with infants. Infants do not engage in conscious self-reflection, and thus the study of emotional development must begin with an emphasis on processes other than conscious, subjective feelings. Infants may not be aware of feelings in the sense discussed in adult theories of emotion, but they do signal their relation to the environment. This provides a conceptual context for the functionalist perspective on emotional development, which defines emotion as a *relational* process rather than as an intrapsychic state. Specifically, this model defines emotion as:

> …the attempt by a person to establish, maintain, change or terminate the relation between the person and the environment on matters of significance to the person. (Campos et al., 1989, p. 395)

Specific emotions reflect different relational stances. Anger reflects effort to change the relation with the environment, to overcome a blocked goal to well-being. Happiness reflects effort to change or maintain a relation with the environment, to achieve or maintain a goal for well-being. Fear reflects an effort to terminate the

relation with the environment, to avoid a threat to a goal for well-being. Sadness reflects ceasing effort to change the relation with the environment, to relinquish a goal for well-being.

The relational definition clearly implies that the process is a continuous, ongoing process of appraising ever-changing circumstances and physiological and motor adjustments that prepare one to act accordingly in the broad service of attaining and sustaining a sense of well-being (Cole, 2016). What historically defined emotion—for example, a subjective feeling or a facial expression—is not emotion but rather one possible outcome of the relational process. The circumstances may result in a facial expression that communicates change in a person's relation to the environment. A subjective feeling signals the change to the self via conscious awareness. In other words, we are always "emotional" but only sometimes does the way we relate to the environment become palpable to others or to ourselves. Thus, the typically developing infant has the adaptive capacity to contribute to its own well-being by communicating to caregivers. Over the course of the life span, this continuous process of relating to the environment occurs mostly out of sight and occasionally emerges in the form of communicative signals or conscious awareness. With development, it becomes possible to be conscious of feelings, to articulate emotions, to read emotions accurately in others, and to develop the full range of emotional competencies (e.g., Saarni, Mumme, & Campos, 1998). In sum, the functionalist perspective on emotional development shifts from a static view of emotion episodes to a view of emotion as a dynamic, emergent process.

Emotional development then involves age-related change in the organization and functional dynamics of this emergent psychological process (Barrett & Campos, 1987; Camras, 2011; Thompson, 1990). In the first few months of life, infants are not able to reflect on their relation to the environment, and their communicative signals are often relatively ambiguous (Camras, 2011). Nonetheless, human infants have the critical capacity to communicate their relation to the environment concerning their well-being. Newborns convey distress that indicates a need to change their relation to the environment to caregivers upon whom they must rely to implement the change. The primary function of emotion in early infancy is communicative, a function that continues through the life span (Saarni et al., 1998).

Over the course of the life span, maturation, learning, and changing environments continue to shape and be shaped by emotional development. To illustrate, consider the first few years of life. Infant development entails extraordinary and rapid growth in multiple domains that entail reorganizations in how infants relate to their environs. As infants acquire sensory, motor, and cognitive capacities, they are better able to perceive the environment and interact with it. For example, in the first few months, visual acuity improves while infants gain experience with their caregivers. Infant attention begins to focus more on the environment, and around the third month of life, infants begin to smile when they perceive a human face, i.e., the social smile (Emde, Gaensbauer, & Harmon, 1976). With further social experience and cognitive development (e.g., object permanency), infants appear to appreciate that not all human faces are associated with the same experiences and begin to prefer their caregivers' faces. They begin to show the relational pattern of withdrawing from, terminating, their relation to the specific environment as indicated by fear-related responses (facial and physiological) to strangers (Campos, Emde, Gaensbauer, & Henderson, 1975; Sroufe, 1977). Increasingly, infants are able not only to signal their needs and intentions but also to take more actions on their own behalf. For example, crawling enables independent movement in the environment, and depth perception enables recognition of new potential dangers (Campos et al., 2000). As infants change, caregiver's communications change, including an increasing array of emotional signals that help define the environment for the infant, e.g., what is safe, which actions meet with approval, and which with disapproval. By the second half of the first year, there are clear indications that infants begin to use caregiver's emotional signals to

guide their own behavior (Klinnert, Emde, Butterfield, & Campos, 1986). Thus, as infants change, their environments change. Their caregivers respond to them differently, they experience and interact with their caregivers and their surrounding environments differently, and how they express emotions changes.

As infants' experiences with the environment change, they develop expectations about how familiar features of the environment operate. With this, they may also develop an implicit sense of their own agency. That is, they form expectations about contingencies, including parental behavior, and when those expectations are violated, infants change their relation to the environment in order to overcome obstacles and regain goals (Lewis, Sullivan, Ramsay, & Alessandri, 1992; Tronick, Als, Adamson, Wise, & Brazelton, 1978). As infants begin to crawl, they gain more autonomy to explore the environment and interact with more objects. An increase in infant anger appears associated with the emergence of crawling (Campos, Kermoian, & Zumbahlen, 1992; Pemberton Roben et al., 2012). Infants appear to develop a sense of themselves and of their agency (e.g., Lewis & Brooks-Gunn, 1979). As they begin to understand and use words, they understand and use their names and terms for their kin and for their body parts, terms that are among the first words in their burgeoning vocabularies (Stipek, Gralinski, & Kopp, 1990). Next comes the use of personal pronouns (Stipek, Recchia, & McClintic, 1992). From this burgeoning language development comes an increasingly sophisticated sense of self contributing to self-other differentiation, which explains observations of guilt, shame, embarrassment, and concern for others in toddlers (Barrett, Cole, & Zahn-Waxler, 1993; Zahn-Waxler, Radke-Yarrow, Wagner, & Chapman, 1992).

These classic studies reveal how very young children's relation to the environment changes in ways that influence their emotional development. Much less is known, however, about the functional value of their emotional development. Studies of preschool-age children, however, demonstrate how anger organizes approach behavior and task persistence in ways that are socially acceptable and desirable (Dennis, Cole, Wiggins, Cohen, & Zalewski, 2009; He, Xu, & Degnan, 2012; see also Lewis et al., 1992 with infant anger). Knowing when and how to communicate emotion, both verbally and nonverbally, serves coping with stress, problem-solving in the family, and friendship formation and maintenance throughout childhood and adolescence (Lemerise & Arsenio, 2000; Sears, Repetti, Reynolds, & Sperling, 2014; Zimmer-Gembeck, Skinner, Morris, & Thomas, 2013).

Sroufe's Theory of Emotional Development

Sroufe (1996) offered a theory of emotional development that focused not only on when emotions appear in childhood but also how they develop. He contended that emotional development is an orderly process and that the developmental order should be parallel for the three major affect systems he posited. He further noted that emotional development is intricately linked to both social and cognitive developments and best understood by considering both proximal and distal mechanisms that explain how emotions emerge. He asserted that emotion is a complex and dynamic process and cannot be defined by simple, single states.

Sroufe's Definition of Emotion

Sroufe drew from all of the major theorists in social psychology to develop a working definition of emotion that could be used in conceptualizing emotional development. Informed by those perspectives, he defined emotion as "a subjective reaction to a salient event, characterized by physiological, experiential, and overt behavioral changes (p. 15)." This emphasizes the occurrence of emotion as an intrapersonal event determined by a person's evaluation of a situation. Furthermore, Sroufe identified the common triad of changes comprising emotion but did not suggest they must co-occur. Sroufe considered the physiological elements of emotion as complex in themselves, involving neural patterns of

activation that are associated with peripheral changes, such as those involving heart rate, blood pressure, sweating, and breathing. Thus, developmental changes in physiological systems have importance for how emotional development unfolds. Sroufe recognized the debate about whether there can be emotion that does not entail a cognitive component, such as appraisal or conscious feeling which is an important matter when considering development in the very first years of life. As a result, Sroufe considered age-related changes in cognitive development as important to the subjective reaction to emotions, but not elements of the emotion itself.

Sroufe regarded emotion as a process rather than as a momentary or static event, which he contends requires thinking of emotion in terms of systems, consistent with the viewpoint of Fogel and Thelen (1987). He contends that there are three specific, distinct affect systems from which emotions develop and in this way draws from the discrete/differential theoretical view of Izard (1971, 1977). Sroufe differentiates the two terms, emotion and affect, which are often treated as synonymous. He reserves the term affect for subjective feeling and expressive behavior, e.g., as when very young infants experience distress when inoculated or pleasure when they are sated. He reserves the term emotion to refer to more complex constellation of reactions in which infants derive meaning from events, which involves a higher-order level of cognitive processing. Infants do more than react to an immediate pain or of fullness but have a capacity to sense the meaning of an event or stimulus for themselves. This distinction is important in his conceptualization of how emotions develop.

Sroufe's Conceptualization of Emotional Development

Sroufe's theory begins with the premise that infants are endowed with three basic emotion systems (innate mechanisms that enable emotional experience), namely, the fear, joy, and anger systems. Each matures in synchrony with the other two, and in concert they form the foundation for the sequential maturation of more complex emotions. That is, these systems change with age, interacting with developmental changes in cognitive and motor development, leading to the emergence of a more complex and diverse set of emotions.

Sroufe's approach is guided by a broader conceptualization of development in terms of hierarchies of organizational changes, as has been described by scholars such as Sander (1975), Werner and Kaplan (1963), and others. Developmental change in this framework is orderly and involves qualitative transitions rather than quantitative changes. What children can do at a later age point builds on what they could do at earlier time points, even as changes are transformative and nonlinear. The changes that occur in emotional development are intricately related to other developmental changes. For example, as infants begin to spend less time asleep, and develop better visual acuity, they spend more time seeing their environment and begin to be interested in and enjoy the environment. A behavior like smiling transitions from being related to internal physiological conditions to being more and more related to the things and persons in the environment. Infants begin to smile at events around them, especially human faces. Then, as they gain increasing experience with faces, they come to appreciate that not all faces hold the same significance. The social smile becomes more differentiated and specific, aimed at familiar faces such as their caregivers' faces, whereas novel faces may elicit wariness, which later can transform into fear.

Sroufe also provided a number of other premises. The hierarchical organizational perspective also posits that actions, transition from global, diffuse states to increasingly specific and coordinated actions. As it relates to emotion, infants' limbs are involved when they are distressed or happy, but, with age, expressive behaviors become more circumscribed, usually limited to changes in facial activity and vocal features. This perspective also emphasizes that changes in one system, e.g., affect systems, are related to changes in other systems. For example, with experience, cognitive capacities develop that help infants remember experiences and anticipate events and behaviors, e.g., when they enjoy a game of peek-

aboo or laugh at a violation of expectations. Another example is the yielding of obligatory attention, i.e., fixed looking at a stimulus, to reactive control of gaze. An example is the way infants come to regulate social interactions with caregivers. They can engage in reactive control of their attention, e.g., shifting gaze away when interaction with the caregiver violates expectations or does not change, but can also shift attention back and re-engage the caregiver, perhaps with vocalizations or smiling. Finally, as these examples suggest, infants become active creators of their environments and in this way active co-contributors to all aspects of their development.

As noted, three systems form the foundations of the more complex repertoire of human emotions—joy, fear, and anger systems. Sroufe drew from the classic work of Bridges (1932) in conceptualizing the developmental differentiation of emotions, but, unlike Bridges, Sroufe focused on how the differentiation emerged. He shared a criticism of Bridges' work with Goodenough (1934), who contended that Bridges underestimated the capabilities of infants in terms of their cognitive abilities. Abilities to anticipate and remember contribute to the emergence of joy, fear, and anger, building on newborns' capacities for distress and pleasure. From the hierarchical organizational perspective, all three should emerge around the same time, namely, the second half of the first year of life. To illustrate, infants develop the ability to manipulate and explore objects often grasping them and bringing them to their mouth; they can also expect that they will achieve such goals. The expectation is not a conscious thought, but it is, nonetheless, an expectation. Infants develop expectations that they can pull a cord and they will see a moving object or grab an object and put it in their mouth; when those expectations are violated, they express anger (Brazelton, 1969; Lewis, Ramsay, & Sullivan, 2006). When their expectations are met, they experience and often express joy. Sroufe regarded these aspects of early infant development as universal, suggesting they are based on a biological readiness.

Sroufe focused heavily on the first 2 years of life, although most of his contributions involve the first year. He points out the significant role of infant emotional capacities as contributors to the development of the attachment system (see Chap. 23); infants contribute emotionally to interactions with caregivers and react to their caregivers in ways that establish the individual differences in types of attachment security. During the second year, maturation and experience lead to the emergence of a basic sense of self. The capacity to appreciate the distinction between self and other then contributes to the development of emotions such as pride, embarrassment, and shame. In addition to these fundamental features of Sroufe's organizational model of emotional development, Sroufe (1996) also discussed briefly the development of emotion regulation, describing as others have, the transition from predominant reliance on caregivers for emotion regulation to the emergence of self-regulation.

Cognition and Emotional Development

There has been a historical distinction between cognition and emotion in psychology (James, 1890), a distinction that can be more pronounced in the developmental literature (especially in infancy). Although a comprehensive review of this literature is beyond the scope of the current review (see Chap. 16), however, we address a few key points here.

Most emotion theories argue that cognition and emotion are intertwined but differ on whether cognition influences or defines emotion (e.g., Lazarus, 2006; Piaget, 1981; Russell, 2006; Vygotksy, 1986). According to Izard's DET, cognition is part of the emotion schema, but not the emotion itself. From an evolutionary perspective, since emotions are adaptive and activated from interactions with our environment, Izard argues that there must be multiple mechanisms that account for emotional processes. Specifically, Izard argues that emotions can be activated by both cognitive and non-cognitive processes (Izard, 1993). For instance, sensory,

neural, and behavioral processes (e.g., facial expressions) can activate emotions. Likewise, with development increasingly sophisticated, cognitive processes, such as appraisals, can also activate emotions. The DET perspective is in contrast to emotion theories in the social psychology literature, often focused largely on adult emotions, which conceptualize cognition as defining discrete emotions. For instance, in the view of core affect theory, emotion is defined by cognitive constructions, or interpretations, of neural sensations reflecting changes in arousal levels of different valence, positive or negative (Barrett, 2011; Posner, Russell, & Peterson, 2005; Russell, 2006).

In Sroufe's (1996) model of emotion development, cognition is one of multiple influences that affects the hierarchical organizational development of emotion. Influences of nervous system activity, perception, cognition, representations (e.g., attachment), and emotion intersect with one, leading to higher and higher levels of integration over the course of development. As a result, cognition and emotion become more intertwined across development. Consider the developmental evolution of smiling, and when it is an index of happiness. Newborns smile while sleeping, thought to be a consequence less of psychological pleasure and more of endogenous physical changes. Soon infants begin to smile when physiologically aroused by external events, but without any evidence that they attribute meaning to the arousing stimuli. However, by 3 months of age, as a function of both social and cognitive development, they recognize human faces and begin to engage in the social smile. This ontogeny of smiling, with its emphasis on hierarchical integration and reorganization of multiple influences, is consistent with the dynamic systems models (see below; Fogel et al., 1992; Lewis & Granic, 2000).

In contrast, the functionalist perspective on emotional development appears to incorporate cognition into the definition of emotion (e.g., Barrett & Campos, 1987). That is, emotion is defined by two component processes—appraisal (processing meaning of stimulus) and action readiness (motoric readiness to act in particular ways). Appraisal is a mental evaluation of the meaning of a stimulus as it pertains to the individual's goals for well-being. In this sense, appraisal is a particular type of cognitive process. Other aspects of cognitive development influence the capacity of the developing individual to appraise; however, appraisal is a sine qua non of emotion and not entirely a separate process that interacts with emotion. Anger is the appraisal that a goal for well-being is attainable but blocked, whereas sadness is the appraisal that a goal for well-being is irretrievably lost. The functionalist perspective asserts that psychological processing of changes, actual or perceived, is one element of emotion.

Theoretical Approaches Applied to the Study of Emotional Development

In this section, we review theories, frameworks, and approaches that are not strictly emotion theories, but have been applied to the study of emotional development.

Dynamic Systems Theory

One of the more common theoretical orientations applied to emotional development is a dynamic systems (DS) theoretical framework (Hollenstein, 2011; Smith & Thelen, 2003; Witherington & Margett, 2011). From a DS perspective, novel skills and habits emerge, stabilize, and consolidate over time within the inner workings of a complex system (Thelen & Smith, 1994, 2007). Emotions are viewed as processes that occur within the system, as opposed to a state, and are closely linked to appraisals about events. A DS approach focuses on the process by which emotions emerge in real-time contexts and change across development (Witherington & Crichton, 2007).

One key concept from DS that has been utilized in studying emotional development is self-organization. Self-organization is the spontaneous emergence of order and stabilization of psychological and neural formations from interactions

between components of a dynamic system that represent conditions in the world (Lewis, 2005). Self-organizing systems become more ordered over time and also become more complex (Lewis & Granic, 2000). In addition, DS approaches have attempted to integrate multiple theoretical approaches and different areas of research on emotional development into one model of the emergence and self-organization of emotions across development (Lewis, 2005).

One example of a DS approach to emotional development is through examining emotional self-organization at three timescales, linking emotional processes that occur during real time to emotional processes that develop across longer spans of time (Lewis, 2005; Lewis & Granic, 2000; Lewis & Liu, 2011). There are three different timescales that come together to form emotion development. The first is self-organization of emotion episodes, or microdevelopment. This involves the convergence of a cognitive state and emotional state over the course of seconds or minutes. At this timescale, emotions are viewed as attractor states (Smith & Thelen, 2003). From a DS perspective, attractors are outcomes of self-organization and endure for some period of time or is a mode of behavior that the system prefers (Lewis, 2005; Thelen & Smith, 2007). The next timescale described is labeled mesodevelopment and involves self-organization in moods that take place over hours and days (Lewis & Granic, 2000). Moods are conceptualized as extended affective states and may be maintained by either cognition or emotion. The more attractor states are reinforced, the more likely they are to occur, and the reinforcement of emotions from microdevelopment feeds into the affective states during mesodevelopment (Lewis & Granic, 2000; Smith & Thelen, 2003). This leads to a temporary modification of a state space, an abstract construct that defines the possible states of the variable (Thelen & Smith, 1994, 2007). Lastly, macrodevelopment level of emotional development involves self-organizing personality patterns. Emotion states that arise from microdevelopment and mesodevelopment lead to lasting interpretive-emotional habits that are specific to different situations. This leads to a permanent structure of the state space. This suggests that salient emotional experiences in early development lay lasting patterns of interpretation that impact self-organization.

Thelen and colleagues provided methodological strategies for empirical tests of dynamic analyses (Thelen & Smith, 1994, 1998). Researchers have integrated measures of physiology, dynamic interactions between parent and child, and behavioral measures of emotion to examine how these processes relate to one another across development. For example, Hollenstein, Granic, Stoolmiller, and Snyder (2004) utilized state-space models to explore rigidity in parent-child interactions to predict both internalizing and externalizing behaviors in children. Similarly, Lunkenheimer and colleagues (Lunkenheimer, Kemp, Lucas-Thompson, Cole, & Albrecht, 2017; Lunkenheimer, Tiberio, Skoranski, Buss, & Cole, 2018) have examined the moment-to-moment dynamic coupling of parent-child interactions and how they may relate to children's behavioral outcomes. More recent research has also integrated measures of parent-child co-regulation of parasympathetic processes and how that interacts with social context to predict child's internalizing and externalizing behaviors (Lunkenheimer et al., 2018). These examples demonstrate how researchers are using dynamic systems approaches in research on child socio-emotional development, and how emotions may emerge in real-time contexts, and their subsequent influence on child development.

Biopsychosocial Perspectives

Biopsychosocial perspectives generally attempt to integrate genetic, neural, behavioral, and environmental levels of analysis to examine both intraorganismic and extraorganismic influences on development (Gottlieb, Wahlsten, & Lickliter, 2007). Moreover, one key concept is the transactional nature of development. Specifically, outcomes are a result of bidirectional influences among the four levels of analyses. The transactional perspective is best epitomized in

another developmental theory, one that is not specific to emotion. Sameroff (2010) asserts that individual development emerges from the interactions of both psychological and biological processes within a child and that these intrapersonal processes interact with—both influence and are influenced by—the environment. The transactional framework does not delve into the specifics of biological processes but rather underscores the bidirectionality of "nature" and "nurture." The specific aspects of biological processes that bear on emotional development include emphases on the central and autonomic nervous systems and the hypothalamic-pituitary-adrenal axis.

Affective Neuroscience, a term coined by Jaak Panksepp, refers to the neurological understanding of the basic emotional operating system of a mammalian brain and the various conscious and unconscious internal states they generate by way of integrating different disciplines and areas of study in psychology (Panksepp, 2004). It has since been used to refer to a broad family of approaches to understanding the neural processes that underlie emotion. In particular, there is an underlying assumption that all mammals share the same basic affective processes and uses research on animal models to inform hypotheses about neural processes related to human emotions (Panksepp, Lane, Solms, & Smith, 2017). Emotional processes are assumed to play a key role in the causal chain of events that control behaviors, and these processes arise from neurobiological events (Panksepp, 2004). Certain brain areas and neurological processes are assumed to underlie basic emotional processes. One of the earliest theoretical examples of the biological "basis" of emotion came from William James and Carl Lange, who independently theorized that the peripheral physiological changes following exposure to a stimulus precede the experience of the emotion. Or more simply stated, that emotions are the physiological changes that the individual feels (Cannon, 1927). In reaction to this perspective, Cannon and Bard's theory challenged this notion and instead suggested that the emotion precedes the physiological reactions (Bard, 1928; Cannon, 1929). According to this hypothalamic theory of emotion which proposed that the hypothalamus evaluates the emotional relevance of environmental events, the expression of emotional responses is mediated by interactions between the hypothalamus and the brainstem, and projections from the hypothalamus to the cortex mediate the conscious experience of emotion.

Turning first to the central nervous system, the limbic system, most often measured via activity of the amygdala and its projections to other subcortical and cortical regions, has been implicated in affective processes. Its most heavily studied function, albeit not its only emotion-related function, has been with the fear system, such as fear conditioning (e.g., LeDoux, 2003). To then understand how emotional development occurs requires an understanding of how neural development interacts with behavioral and environmental processes. That is, this viewpoint assumes that maturation in the central nervous system leads to developmental changes in emotion processing. Moreover, the developmental changes involve the establishment of an efficient network in which subcortical limbic regions interact with cortical regions (e.g., prefrontal cortex). This enables re-representation and refinement of the associations between emotions and behaviors such that humans learn to make effective behavioral choices based on emotional experiences (Panksepp, 2004). Furthermore, Panskepp contends that the neural systems underlying fear, anger, and separation distress emerge in the first years of life and are critical to survival. Other emotions that are more complex (e.g., shame) result from social experiences and emerge later in childhood. Evidence indicates that experience changes neural architecture, which underscores the importance of appreciating the bidirectional nature of environmental context and biological functioning in understanding emotional development.

Another perspective among biopsychosocial theories of emotion development focuses on the autonomic nervous system, that is, the system that extends from the central nervous system to the organs and limbs. Polyvagal theory (Porges, 1995) is one prominent theory with this focus. It

has been utilized to examine ways in which autonomic nervous system functioning is related to emotional experience in childhood, with a focus on the role of the vagus nerve in regulating heart rate and respiration (Porges, 1995). One of the tenets of polyvagal theory is that primary emotions are related to autonomic functioning (Porges, 2007). The polyvagal theory posits that the evolution of the autonomic nervous system provides neurophysiological substrates for affective experiences and processes related to social communication and behaviors. Porges (2007) suggests that the autonomic nervous system determines the range of emotional expression, quality of communication, and ability to regulate bodily and behavioral states. The activity of the vagus nerve cannot be measured directly, and researchers have often examined heart rate variability (HRV) and respiratory sinus arrhythmia (RSA), specifically, to examine the links between parasympathetic activity and emotional development. Generally, there have been different experimental approaches to examining RSA, which include treating RSA as an inherent individual difference or trait-like variable similar to temperament. Alternatively, researchers have equated changes in RSA as a measure of mental effort or attention (Porges, 2007).

Although not a specific biomarker of emotional processes, work by Beauchaine and colleagues have posited that RSA is a biomarker of emotion regulation in developmental populations, and changes in RSA reflect an index of children's capability to regulate their emotional responses to both positive and negative stimuli (Beauchaine, 2001; Beauchaine, Gatzke-Kopp, & Mead, 2007). Studies across development have linked variation in RSA to emotional reactivity and regulation (Brooker & Buss, 2010; Buss, Hill Goldsmith, & Davidson, 2005; Stifter, Dollar, & Cipriano, 2011; Stifter & Fox, 1990), frustration and risk for externalizing (Calkins & Dedmon, 2000; Calkins, Dedmon, Gill, Lomax, & Johnson, 2002), and fear dysregulation and social inhibition (Buss, Davis, Ram, & Coccia, 2018). However, RSA does not operate in isolation. It has been suggested that environmental influences may alter some of the biological processes related to RSA, especially during the preschool period when these biological systems may be particularly malleable (e.g., Beauchaine et al., 2007). For comprehensive review of this work, see Chap. 3.

Sociocultural Theories of Emotional Development

Emotional development has also been examined using a sociocultural lens, wherein emotional development is the result of the individual participating in cultural scripts and practices related to emotion. From this perspective, emotions are based on appraisals that become increasingly linked to symbol-based meanings that are the product of sociocultural environments (Holodynski & Friedlmeier, 2005).

One example of a sociocultural theory of emotional development is the internalization model presented by Holodynski and Friedlmeier (2005). The internalization model suggests that emotions are comprised of their regulatory functions and systemic components, which include the appraisal system, motor system, body regulation system, and the feeling system. Emotional expression signs and regulation strategies develop as a result of interactions between caregivers and children and later become a key communicative function in emotional development. A person's emotional development becomes individualized during ontogenesis, but emotional development proceeds within a cultural context. As part of emotional development, emotional expression signs are the main method by which children and their caregivers convey their emotions. The coordination of facial expressions of emotions with other behaviors is developed through socialization experiences with caregivers early in development. On the other hand, regulation strategies determine how well emotions are integrated into individual and social activity regulations. Both components are viewed as products of culture-historical symbol formation processes.

Information Processing Approaches

Another framework that researchers have utilized to study emotion development is an information processing approach (Simon, 1979). Information processing models are primarily used to model human cognitive processes and encourage attention to processes (Simon, 1979). Mechanisms underlying development in this framework include processes such as automatization, encoding, generalization, and strategy construction (Miller, 2016).

One specific model of information processing that has been utilized in the study of socioemotional development is social information processing (Crick & Dodge, 1996; Lemerise & Arsenio, 2000). Social information processing models were developed with the goal of understanding variations in social behavior, such as aggression and social competency (e.g., Dodge et al., 2003).

Some theorists have posited that emotion is distinct from social information processing (e.g., Gottman, 1986), though some have argued that emotions and social information processes are integrated (Crick & Dodge, 1996). Notably, Crick and Dodge (1996) argue that emotions play an important role in social information processing, though they did not integrate affective processes into their model. Lemerise and Arsenio (2000) detail how emotions influence the various cognitive processes outlined by Crick and Dodge (1996). In particular, they outlined how emotions can influence the interpretation of social situations and how understanding of affect may influence the encoding of social interactions. Prior research has shown that the emotional displays of the provocateur influence children's goals and social problem-solving (Lemerise, Fredstrom, Kelley, Bowersox, & Waford, 2006; Lemerise, Gregory, & Fredstrom, 2005). Similarly, Harper, Lemerise, and Caverly (2010) demonstrated that happy, angry, or neutral mood induction influenced children's preferred goals in social situations. In addition, research has suggested there is an increased focus on relationship-maintaining goals with increasing age (Lemerise et al., 2005).

However, information processing models have not yet provided an account of how emotional development occurs, though it is clear that emotions interact with cognitive processes to shape social behavior. For instance, a social information processing model can be applied to the development of mood disorders and anxiety. For example, Prinstein, Cheah, and Guyer (2005) examined the joint effects of peer victimization and cue interpretation on internalizing symptoms in children and adolescents. Findings suggest that certain forms of cue interpretation, such as self-referent attributions during ambiguous social interactions, are more strongly related to depressive symptoms in the context of greater peer victimization, suggesting that social information processes can underlie emotional development in children and adolescents.

Concluding Thoughts: Application of Emotion Theory to Developmental Science

It is both exciting and exasperating that emotional development theory is still in its own state of development. We urge emotional development researchers to read the available theories, summarized in this chapter, and to consider their positions on how they define emotion and how they conceptualize developmental change in emotion or aspects of emotional functioning. In this way, empirical evidence can contribute to theory development.

As this chapter notes, emotion theory has largely focused on adults, and emotional development theory has largely focused on infancy and early childhood (see Chap. 24 on adolescent emotional development). To some extent, the available evidence in infancy and early childhood (and may include the prenatal period) points to potential origins of emotional development, and the evidence regarding adult emotional functioning suggests outcomes later in life that suggest outcomes of emotional development trajectories.

As developmental science advances, one question we anticipate is how we will come to

understand the distinction between emotion as a process and other psychological processes, e.g., cognition. If appraisal is at the core of emotional processing, regardless of whether that is biologically determined or a higher-order linguistic form, does emotional processing differ from other forms of information processing? In our view, fundamental questions such as this remain to be addressed. Emotion is so essential to human functioning that our research enterprises have, in some respects, hurried past basic definition and theory and incorporated emotion into our work on basic individual differences (e.g., temperament; see Chap. 7), on basic human relationships (e.g., attachment; see Chap. 25), and on a variety of outcomes (e.g., emotional competence and psychological adjustment; see Chaps. 21, 26, and 27). For those who delve seriously into the questions of what emotion is and how it develops, these applications of emotion may provide guidance.

Finally, there are clear and urgent needs to understand emotion and its development. In classrooms, in clinics, and in communities throughout the world, there are concerns about the emotional development and difficulties of children and adults. The world is a challenging place, and all individuals, regardless of location, strive to get their needs met (a basic adaptive role of emotion), to establish and maintain good relationships (a basic adaptive role of emotion), and to coordinate getting individual needs met with living in close relationships and social networks.

References

Ackerman, B. P., Abe, J. A. A., & Izard, C. E. (1998). Differential emotions theory and emotional development. In M. F. Mascolo & S. Griffin (Eds.), *What develops in emotional development?* (pp. 85–106). Boston, MA: Springer US. https://doi.org/10.1007/978-1-4899-1939-7_4

Arnold, M. B. (1960). *Emotion and personality*. New York, NY: Columbia University Press.

Bard, P. (1928). A diencephalic mechanism for the expression of rage with special reference to the sympathetic nervous system. *American Journal of Physiology, 84*, 490–516.

Barrett, K. C., & Campos, J. J. (1987). Perspectives on emotional development II: A functionalist approach to emotions. In *Handbook of infant development* (pp. 555–578). Oxford, UK: Wiley.

Barrett, K. C., Cole, P. M., & Zahn-Waxler, C. (1993). Avoiders vs. Amenders: Implications for the investigation of guilt and shame during Toddlerhood? *Cognition and Emotion, 7*(6), 481–505. https://doi.org/10.1080/02699939308409201

Barrett, L. F. (2006). Valence is a basic building block of emotional life. *Journal of Research in Personality, 40*(1), 35–55. https://doi.org/10.1016/j.jrp.2005.08.006

Barrett, L. F. (2011). Was Darwin wrong about emotional expressions? *Current Directions in Psychological Science, 20*(6), 400–406. https://doi.org/10.1177/0963721411429125

Barrett, L. F., Lewis, M., & Haviland-Jones, J. M. (2018). *Handbook of emotions* (4th ed.). New York, NY: The Guilford Press.

Barrett, L. F., Lindquist, K. A., & Gendron, M. (2007). Language as context for the perception of emotion. *Trends in Cognitive Sciences, 11*(8), 327–332. https://doi.org/10.1016/j.tics.2007.06.003

Barrett, L. F., Mesquita, B., & Gendron, M. (2011). Context in emotion perception. *Current Directions in Psychological Science, 20*(5), 286–290. https://doi.org/10.1177/0963721411422522

Beauchaine, T. (2001). Vagal tone, development, and Gray's motivational theory: Toward an integrated model of autonomic nervous system functioning in psychopathology. *Development and Psychopathology, 13*(2), 183–214. https://doi.org/10.1017/S0954579401002012

Beauchaine, T. P., Gatzke-Kopp, L., & Mead, H. K. (2007). Polyvagal theory and developmental psychopathology: Emotion dysregulation and conduct problems from preschool to adolescence. *Biological Psychology, 74*(2), 174–184. https://doi.org/10.1016/j.biopsycho.2005.08.008

Brazelton, T. B. (1969). *Infants and mothers: Differences in development*. New York, NY: Delacorte Press.

Bridges, K. M. B. (1932). Emotional development in early infancy. *Child Development, 3*(4), 324. https://doi.org/10.2307/1125359

Brooker, R. J., & Buss, K. A. (2010). Dynamic measures of RSA predict distress and regulation in toddlers. *Developmental Psychobiology, 52*(4), 372–382. https://doi.org/10.1002/dev.20432

Buss, K. A., Davis, E. L., Ram, N., & Coccia, M. (2018). Dysregulated fear, social inhibition, and respiratory sinus arrhythmia: A replication and extension. *Child Development, 89*(3), 214–228. https://doi.org/10.1111/cdev.12774

Buss, K. A., Hill Goldsmith, H., & Davidson, R. J. (2005). Cardiac reactivity is associated with changes in negative emotion in 24-month-olds. *Developmental Psychobiology, 46*(2), 118–132. https://doi.org/10.1002/dev.20048

Calkins, S. D., & Dedmon, S. E. (2000). Physiological and behavioral regulation in two-year-old children with aggressive/destructive behavior problems. *Journal of Abnormal Child Psychology, 28*(2), 103–118.

Calkins, S. D., Dedmon, S. E., Gill, K. L., Lomax, L. E., & Johnson, L. M. (2002). Frustration in infancy: Implications for emotion regulation, physiological processes, and temperament. *Infancy, 3*(2), 175–197. https://doi.org/10.1207/S15327078IN0302_4

Campos, J. J., Anderson, D. I., Barbu-Roth, M. A., Hubbard, E. M., Hertenstein, M. J., & Witherington, D. (2000). Travel broadens the mind. *Infancy, 1*(2), 149–219. https://doi.org/10.1207/S15327078IN0102_1

Campos, J. J., & Barrett, K. C. (1984). Toward a new understanding of emotions and their development. In C. E. Izard & R. B. Zajonc (Eds.), *Emotions, cognition, and behavior* (pp. 229–263). New York: Cambridge University Press.

Campos, J. J., Campos, R. G., & Barrett, K. C. (1989). Emergent themes in the study of emotional development and emotion regulation. *Developmental Psychology, 25*(3), 394–402. https://doi.org/10.1037/0012-1649.25.3.394

Campos, J. J., Emde, R. N., Gaensbauer, T., & Henderson, C. (1975). Cardiac and behavioral interrelationships in the reactions of infants to strangers. *Developmental Psychology, 11*(5), 589–601. https://doi.org/10.1037/0012-1649.11.5.589

Campos, J. J., Kermoian, R., & Zumbahlen, M. R. (1992). Socioemotional transformations in the family system following infant crawling onset. *New Directions for Child and Adolescent Development, 1992*(55), 25–40. https://doi.org/10.1002/cd.23219925504

Camras, L. A. (2011). Differentiation, dynamical integration and functional emotional development. *Emotion Review, 3*(2), 138–146. https://doi.org/10.1177/1754073910387944

Camras, L. A., & Fatani, S. S. (2008). The development of facial expressions: Current perspectives on infant emotions. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 291–303). New York: Guilford Press.

Cannon, W. B. (1927). The James-Lange theory of emotions: A critical examination and an alternative theory. *The American Journal of Psychology, 39*(1), 106. https://doi.org/10.2307/1415404

Cannon, W. B. (1929). Organization for physiological homeostasis. *Physiological Reviews, 9*(3), 399–431. https://doi.org/10.1152/physrev.1929.9.3.399

Cole, P. M. (2016). Emotion and the development of psychopathology. In D. Cicchetti (Ed.), *Developmental psychopathology* (3rd ed., pp. 1–60). Hoboken, NJ: John Wiley & Sons, Inc. https://doi.org/10.1002/9781119125556.devpsy107

Cole, P. M., & Moore, G. A. (2015). About face! Infant facial expression of emotion. *Emotion Review, 7*(2), 116–120. https://doi.org/10.1177/1754073914554786

Crick, N. R., & Dodge, K. A. (1996). Social information-processing mechanisms in reactive and proactive aggression. *Child Development, 67*(3), 993. https://doi.org/10.2307/1131875

Darwin, C. (1872). *The expression of the emotions in man and animals*. London, UK: Fontana Press.

Darwin, C. (2009). In F. Darwin (Ed.), *The expression of the emotions in man and animals* (2nd ed.). Cambridge, UK: Cambridge University Press. https://doi.org/10.1017/CBO9780511694110

Dennis, T. A., Cole, P. M., Wiggins, C. N., Cohen, L. H., & Zalewski, M. (2009). The functional organization of preschool-age children's emotion expressions and actions in challenging situations. *Emotion, 9*(4), 520–530. https://doi.org/10.1037/a0016514

Dodge, K. A., Lansford, J. E., Burks, V. S., Bates, J. E., Pettit, G. S., Fontaine, R., & Price, J. M. (2003). Peer rejection and social information-processing factors in the development of aggressive behavior problems in children. *Child Development, 74*(2), 374–393. https://doi.org/10.1111/1467-8624.7402004

Ekman, P. (1977). Biological and cultural contributions to body and facial movement. In J. Blacking (Ed.), *The anthropology of the body* (pp. 34–84). London, UK: Academic Press.

Ekman, P. (1992). An argument for basic emotions. *Cognition and Emotion, 6*(3–4), 169–200. https://doi.org/10.1080/02699939208411068

Ekman, P., & Cordaro, D. (2011). What is meant by calling emotions basic. *Emotion Review, 3*(4), 364–370. https://doi.org/10.1177/1754073911410740

Ekman, P., & Freisen, W. V. (1969). The repertoire or nonverbal behavior: Categories, origins, usage, and coding. *Semiotica, 1*, 49–98.

Ekman, P., Freisen, W. V., & Ancoli, S. (1980). Facial signs of emotional experience. *Journal of Personality and Social Psychology, 39*(6), 1125–1134. https://doi.org/10.1037/h0077722

Ekman, P., & Friesen, W. V. (1971). Constants across cultures in the face of emotion. *Journal of Personality and Social Psychology, 17*, 124–129.

Ekman, P., & Friesen, W. V. (1978). *The facial affect coding system*. Palo Alto, CA: Consulting Psychologists Press.

Ekman, P. E., & Davidson, R. J. (1994). *The nature of emotion: Fundamental questions* (1st ed.). New York, NY: Oxford University Press.

Emde, R. N., Gaensbauer, T. J., & Harmon, R. J. (1976). Emotional expression in infancy: A biobehavioral study. *Psychological Issues, 10*, 1–200.

Fogel, A., Nwokah, E., Dedo, J. Y., Messinger, D., Dickson, K. L., Matusov, E., & Holt, S. A. (1992). Social process theory of emotion: A dynamic systems approach. *Social Development, 1*, 122–142. https://doi.org/10.1111/j.1467-9507.1992.tb00116.x

Fogel, A., & Thelen, E. (1987). Development of early expressive and communicative action: Reinterpreting the evidence from a dynamic systems perspective. *Developmental Psychology, 23*(6), 747–761. https://doi.org/10.1037/0012-1649.23.6.747

Fox, A. S., Lapate, R. C., Shackman, A. J., & Davidson, R. J. (2018). *The nature of emotion: Fundamental*

questions (2nd ed.). New York, NY: Oxford University Press.

Frijda, N. H. (1986). *Studies in emotion and social interaction. The emotions*. New York, NY: Cambridge University Press.

Goodenough, F. (1934). *Developmental Psychology*. New York, NY: Appleton-Century.

Gottlieb, G., Wahlsten, D., & Lickliter, R. (2007). The significance of biology for human development: A developmental psychobiological systems view. In W. Damon & R. M. Lerner (Eds.), *Handbook of child psychology* (pp. 210–257). Hoboken, NJ: John Wiley & Sons, Inc. https://doi.org/10.1002/9780470147658

Gottman, J. (1986). The observation of social process. In J. Gottman and J. Parker (Eds.), Conversation ofFriends, NY: Cambridge University Press

He, J., Xu, Q., & Degnan, K. A. (2012). Anger expression and persistence in young children: Child anger expression and persistence. *Social Development, 21*(2), 343–353. https://doi.org/10.1111/j.1467-9507.2011.00622.x

Harper, B. D., Lemerise, E. A., & Caverly, S. L. (2010). The effect of induced mood on children's social information processing: Goal clarification and response decision. *Journal of Abnormal Child Psychology, 38*(5), 575–586. https://doi.org/10.1007/s10802-009-9356-7

Hollenstein, T. (2011). Twenty years of dynamic systems approaches to development: Significant contributions, challenges, and future directions: 20 years of dynamic systems. *Child Development Perspectives, 5*(4), 256–259. https://doi.org/10.1111/j.1750-8606.2011.00210.x

Hollenstein, T., Granic, I., Stoolmiller, M., & Snyder, J. (2004). Rigidity in parent–child interactions and the development of externalizing and internalizing behavior in early childhood. *Journal of Abnormal Child Psychology, 32*(6), 595–607. https://doi.org/10.1023/B:JACP.0000047209.37650.41

Holodynski, M., & Friedlmeier, W. (2005). *Development of emotions and their regulation: An internalizing model*. New York, NY: Springer.

Izard, C. E. (1971). *The face of emotion*. New York, NY: Appleton-Century-Crofts.

Izard, C. E. (1977). *Human emotions*. New York, NY: Plenum.

Izard, C. E. (1993). Four systems for emotion activation: Cognitive and non-cognitive processes. *Psychological Review, 100*, 68–90.

Izard, C. E. (2007). Basic emotions, natural kinds, emotion schemas, and a new paradigm. *Perspectives on Psychological Science, 2*(3), 260–280. https://doi.org/10.1111/j.1745-6916.2007.00044.x

Izard, C. E., & Abe, J. A. A. (2004). Developmental changes in facial expressions of emotions in the strange situation during the second year of life. *Emotion, 4*(3), 251–265. https://doi.org/10.1037/1528-3542.4.3.251

Izard, C. E., Fantauzzo, C. A., Castle, J. M., Haynes, O. M., et al. (1995). The ontogeny and significance of infants' facial expressions in the first 9 months of life. *Developmental Psychology, 31*(6), 997–1013. https://doi.org/10.1037/0012-1649.31.6.997

James, W. (1890). *The principles of psychology*. New York, NY: Henry Holt.

Johnson-Laird, P. N., & Oatley, K. (1992). Basic emotions, rationality, and folk theory. *Cognition and Emotion, 6*(3–4), 201–223. https://doi.org/10.1080/02699939208411069

Keltner, D., & Gross, J. J. (1999). Functional accounts of emotions. *Cognition & Emotion, 13*(5), 467–480. https://doi.org/10.1080/026999399379140

Klinnert, M. D., Emde, R. N., Butterfield, P., & Campos, J. J. (1986). Social referencing: The infant's use of emotional signals from a friendly adult with mother present. *Developmental Psychology, 22*(4), 427–432. https://doi.org/10.1037/0012-1649.22.4.427

Lang, P. J. (1994). The varieties of emotional experience: A meditation on James-Lange theory. *Psychological Review, 101*(2), 211–221. https://doi.org/10.1037/0033-295X.101.2.211

Lazarus, R. S. (1991). Progress on a cognitive-motivational-relational theory of emotion. *American Psychologist, 46*(8), 819–834. https://doi.org/10.1037/0003-066X.46.8.819

Lazarus, R. S. (2006). *Stress and emotion: A new synthesis*. New York, NY: Springer Publishing Company.

LeDoux, J. (2003). The emotional brain, fear, and the amygdala. *Cellular and Molecular Neurobiology, 23*(4–5), 727–738.

Lemerise, E. A., & Arsenio, W. F. (2000). An integrated model of emotion processes and cognition in social information processing. *Child Development, 71*(1), 107–118.

Lemerise, E. A., Fredstrom, B. K., Kelley, B. M., Bowersox, A. L., & Waford, R. N. (2006). Do provocateurs' emotion displays influence children's social goals and problem solving? *Journal of Abnormal Child Psychology, 34*(4), 555–567. https://doi.org/10.1007/s10802-006-9035-x

Lemerise, E. A., Gregory, D. S., & Fredstrom, B. K. (2005). The influence of provocateurs' emotion displays on the social information processing of children varying in social adjustment and age. *Journal of Experimental Child Psychology, 90*(4), 344–366. https://doi.org/10.1016/j.jecp.2004.12.003

Lewis, M., & Brooks-Gunn, J. (1979). Toward a theory of social cognition: The development of self. *New Directions for Child and Adolescent Development, 1979*(4), 1–20. https://doi.org/10.1002/cd.23219790403

Lewis, M., Haviland-Jones, J. M., & Barrett, L. F. (Eds.). (2008). *Handbook of Emotions* (3rd ed.). New York: The Guilford press.

Lewis, M., Ramsay, D. S., & Sullivan, M. W. (2006). The relation of ANS and HPA activation to infant anger and sadness response to goal blockage. *Developmental Psychobiology, 48*(5), 397–405. https://doi.org/10.1002/dev.20151

Lewis, M., Sullivan, M. W., Ramsay, D. S., & Alessandri, S. M. (1992). Individual differences in anger and sad expressions during extinction: Antecedents and consequences. *Infant Behavior and Development, 15*(4), 443–452. https://doi.org/10.1016/0163-6383(92)80012-J

Lewis, M. D. (2005). Bridging emotion theory and neurobiology through dynamic systems modeling. *Behavioral and Brain Sciences, 28*(02). https://doi.org/10.1017/S0140525X0500004X

Lewis, M. D., & Granic, I. (2000). *Emotion, development, and self-organization: Dynamic systems approaches to emotional development*. Cambridge, UK: Cambridge University Press. https://doi.org/10.1017/CBO9780511527883

Lewis, M. D., & Liu, Z. (2011). Three time scales of neural self-organization underlying basic and nonbasic emotions. *Emotion Review, 3*(4), 416–423. https://doi.org/10.1177/1754073911410748

Lunkenheimer, E., Kemp, C. J., Lucas-Thompson, R. G., Cole, P. M., & Albrecht, E. C. (2017). Assessing biobehavioural self-regulation and coregulation in early childhood: The parent-child challenge task: The parent-child challenge task. *Infant and Child Development, 26*(1), e1965. https://doi.org/10.1002/icd.1965

Lunkenheimer, E., Tiberio, S. S., Skoranski, A. M., Buss, K. A., & Cole, P. M. (2018). Parent-child coregulation of parasympathetic processes varies by social context and risk for psychopathology. *Psychophysiology, 55*(2), e12985. https://doi.org/10.1111/psyp.12985

Miller, P. H. (2016). *Theories of developmental psychology* (6th ed.). New York, NY: Worth Publishers.

Panksepp, J. (2004). *Affective neuroscience: The foundations of human and animal emotions*. Oxford, MS: Oxford University Press.

Panksepp, J., Lane, R. D., Solms, M., & Smith, R. (2017). Reconciling cognitive and affective neuroscience perspectives on the brain basis of emotional experience. *Neuroscience & Biobehavioral Reviews, 76*, 187–215. https://doi.org/10.1016/j.neubiorev.2016.09.010

Pemberton Roben, C. K., Bass, A. J., Moore, G. A., Murray-Kolb, L., Tan, P. Z., Gilmore, R. O., … Teti, L. O. (2012). Let me go: The influences of crawling experience and temperament on the development of anger expression: Crawling and anger expression. *Infancy, 17*(5), 558–577. https://doi.org/10.1111/j.1532-7078.2011.00092.x

Piaget, J. (1981). Intelligence and affectivity: Their relationship during child development. Translated and edited by Brown, T. A., Kaegi, C. E., & Rosenzweig, M. R.,Annual Review Monographs, Palo Alto, CA: Annual Reviews Inc. (original work published 1954).

Porges, S. W. (1995). Cardiac vagal tone: A physiological index of stress. *Neuroscience & Biobehavioral Reviews, 19*(2), 225–233. https://doi.org/10.1016/0149-7634(94)00066-A

Porges, S. W. (2007). The polyvagal perspective. *Biological Psychology, 74*(2), 116–143. https://doi.org/10.1016/j.biopsycho.2006.06.009

Posner, J., Russell, J., & Peterson, B. (2005). The circumplex model of affect: An integrative approach to affective neuroscience, cognitive development, and psychopathology. *Development and Psychopathology, 17*(3), 715–734. https://doi.org/10.1017/S0954579405050340

Prinstein, M. J., Cheah, C. S. L., & Guyer, A. E. (2005). Peer victimization, Cue interpretation, and internalizing symptoms: Preliminary concurrent and longitudinal findings for children and adolescents. *Journal of Clinical Child & Adolescent Psychology, 34*(1), 11–24. https://doi.org/10.1207/s15374424jccp3401_2

Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review, 110*(1), 145–172. https://doi.org/10.1037/0033-295X.110.1.145

Russell, J. A. (2006). Emotions are not modules. *Canadian Journal of Philosophy, 32*, 53–72.

Russell, J. A. (2009). Emotion, core affect, and psychological construction. *Cognition and Emotion, 23*(7), 1259–1283. https://doi.org/10.1080/02699930902809375

Saarni, C., Mumme, D. L., & Campos, J. J. (1998). Emotional development: Action, communication, and understanding. In W. Damon & N. Eisenberg (Eds.), *Handbook of child psychology: Social, emotional, and personality development* (pp. 237–309). Hoboken, NJ: John Wiley & Sons, Inc.

Sameroff, A. (2010). A unified theory of development: A dialectic integration of nature and nurture. *Child Development, 81*(1), 6–22. https://doi.org/10.1111/j.1467-8624.2009.01378.x

Sander, L. W. (1975). Infant and caretaking environment investigation and conceptualization of adaptive behavior in a system of increasing complexity. In E. J. Anthony (Ed.), *Explorations in child psychiatry* (pp. 129–166). Boston, MA: Springer US. https://doi.org/10.1007/978-1-4684-2127-9_10

Scherer, K. (2003). Vocal communication of emotion: A review of research paradigms. *Speech Communication, 40*(1–2), 227–256. https://doi.org/10.1016/S0167-6393(02)00084-5

Scherer, K. R. (1986). Vocal affect expression: A review and a model for future research. *Psychological Bulletin, 99*(2), 143–165. https://doi.org/10.1037//0033-2909.99.2.143

Sears, M. S., Repetti, R. L., Reynolds, B. M., & Sperling, J. B. (2014). A naturalistic observational study of children's expressions of anger in the family context. *Emotion, 14*(2), 272–283. https://doi.org/10.1037/a0034753

Simon, H. A. (1979). Information processing models of cognition. *Annual Review of Psychology, 30*(1), 363–396. https://doi.org/10.1146/annurev.ps.30.020179.002051

Smith, L. B., & Thelen, E. (2003). Development as a dynamic system. *Trends in Cognitive Sciences, 7*(8), 343–348. https://doi.org/10.1016/S1364-6613(03)00156-6

Sroufe, L. A. (1977). Wariness of strangers and the study of infant development. *Child Development, 48*, 731–746. https://doi.org/10.2307/1128323

Sroufe, L. A. (1996). *Emotional development: The organization of emotional life in the early years*. Cambridge, UK: Cambridge University Press. https://doi.org/10.1017/CBO9780511527661

Stifter, C. A., Dollar, J. M., & Cipriano, E. A. (2011). Temperament and emotion regulation: The role of

autonomic nervous system reactivity. *Developmental Psychobiology, 53*(3), 266–279. https://doi.org/10.1002/dev.20519

Stifter, C. A., & Fox, N. A. (1990). Infant reactivity: Physiological correlates of newborn and 5-month temperament. *Developmental Psychology, 26*(4), 582–588. https://doi.org/10.1037/0012-1649.26.4.582

Stipek, D. J., Gralinski, J. H., & Kopp, C. B. (1990). Self-concept development in the toddler years. *Developmental Psychology, 26*(6), 972–977. https://doi.org/10.1037/0012-1649.26.6.972

Stipek, D., Recchia, S., & McClintic, S. (1992). Self-evaluation in young children. Monographs of the Society for Research in Child Development, *57*(1), 100.

Thelen, E., & Smith, L. B. (1994). *A dynamic systems approach to the development of cognition and action*. Cambridge, MA: MIT Press.

Thelen, E., & Smith, L. B. (1998). Dynamic systems theories. In W. Damon, R. M. Lerner, & N. Eisenberg (Eds.), *Handbook of child psychology* (Vol. 1, pp. 563–634).

Thelen, E., & Smith, L. B. (2007). Dynamic systems theories. In W. Damon & R. M. Lerner (Eds.), *Handbook of child psychology* (6th ed., pp. 258–312). Hoboken, NJ: John Wiley & Sons, Inc. https://doi.org/10.1002/9780470147658

Thompson, R. A. (1990). Emotion and self-regulation. In R. A. Thompson (Ed.), *Socioemotional development. Nebraska symposium on motivation* (Vol. 36, pp. 367–467).

Tomkins, S. S. (1962). *Affect imagery consciousness. Vol I: The positive affects*. Oxford, UK: Springer.

Tomkins, S. S., & McCarter, R. (1964). What and where are the primary affects? Some evidence for a theory. *Perceptual and Motor Skills, 18*(1), 119–158. https://doi.org/10.2466/pms.1964.18.1.119

Tronick, E., Als, H., Adamson, L., Wise, S., & Brazelton, T. B. (1978). The Infant's response to entrapment between contradictory messages in face-to-face interaction. *Journal of the American Academy of Child Psychiatry, 17*(1), 1–13. https://doi.org/10.1016/S0002-7138(09)62273-1

Vygotksy, L. S. (1986). *Thought and language*. Cambridge, MA: MIT Press.

Werner, H., & Kaplan, B. (1963). *Symbol formation: An organismic-developmental approach to language and the expression of thought*. New York, NY: Wiley.

Witherington, D. C., & Crichton, J. A. (2007). Frameworks for understanding emotions and their development: Functionalist and dynamic systems approaches. *Emotion, 7*(3), 628–637. https://doi.org/10.1037/1528-3542.7.3.628

Witherington, D. C., & Margett, T. E. (2011). How conceptually unified is the dynamic systems approach to the study of psychological development?: Conceptual unification in dynamic systems. *Child Development Perspectives, 5*(4), 286–290. https://doi.org/10.1111/j.1750-8606.2011.00211.x

Zahn-Waxler, C., Radke-Yarrow, M., Wagner, E., & Chapman, M. (1992). Development of concern for others. *Developmental Psychology, 28*(1), 126–136. https://doi.org/10.1037/0012-1649.28.1.126

Zimmer-Gembeck, M. J., Skinner, E. A., Morris, H., & Thomas, R. (2013). Anticipated coping with interpersonal stressors: Links with the emotional reactions of sadness, anger, and fear. *The Journal of Early Adolescence, 33*(5), 684–709. https://doi.org/10.1177/0272431612466175

Get Bent Into Shape: The Non-linear, Multi-system, Contextually-embedded Psychophysiology of Emotional Development

Paul D. Hastings and Sarah Kahle

Abstract

Psychophysiological aspects of emotional development have been studied for several decades, yet recent years have borne witness to impressive advances in the sophistication of theoretical, procedural, and analytical approaches that scholars have brought to this field. In this chapter, Hastings and Kahle review several of the perennial challenges that are inherent to the study of developmental affective psychophysiology and consider the insights that have emerged over the past two decades as researchers have sought to address these challenges. In particular, they argue that the psychophysiology of emotional development should be understood and studied as dynamic processes embedded in situational and relationship contexts, both shaping and being shaped by personal experiences, and involving the coordination of multiple physiological systems with the other essential elements of emotional functioning.

> The best and most beautiful things in the world cannot be seen or even touched. They must be felt with the heart.
> Anne Sullivan via Helen Keller, The Story of My Life, 1903/2010

What are emotions, and what does it mean to study the psychophysiology of emotional development?

Damasio (2000) characterized emotions as representations in the brain of the relation(s) between oneself and an evoking stimulus, manifested through automatic and predictable or stereotypic alterations to brain, autonomic and somatic activity, that prime the self for responding to the stimulus. This focus on emotions as biologically prepared adaptive processes is rooted in a functional perspective on the evolutionary framework and is reflected in most definitions of emotions espoused by affective and developmental scientists (Bradley & Lang, 2007; Cole, Martin, & Dennis, 2004; Dennis, Buss, & Hastings, 2012; Thompson, 2011). Emotions are integrative processes of changes in the neurobiological, perceptual, cognitive, and behavioral systems that serve to support effective engagement with and response to important cues and events within one's social context in order to sus-

P. D. Hastings (✉)
University of California—Davis, Department of Psychology, Davis, CA, USA
e-mail: pdhastings@ucdavis.edu

S. Kahle
University of California Davis School of Medicine, Department of Psychiatry and Behavioral Sciences, Sacramento, CA, USA

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_3

tain or attain well-being. Lest we overlook the wider lay-understanding of what emotions are, it is also important to note that "feelings" are the subjective and personally recognized experiences of these processes.

A challenge that is inherent to all developmental research is that the focus of interest is in a process of change; sometimes, change itself is the focus of interest. When studying the psychophysiology of emotional development, that challenge is multiplied many times over. Emotions are not "things"; they are processes, and thus, they are themselves change—the result of change in the relation between environment and person; the emergent sum of multifaceted change in mind, brain, and body; and the spark for subsequent change in the relation between person and environment as emotions motivate actions and reactions. Although there are expected ways in which these change processes are typically manifest, there is also considerable variability due to the unique life histories and learning experiences of people. In effect, then, the student or scholar of developmental affective psychophysiology is trying to understand the contextually embedded temporal coordination of multiple moving targets over multiple time scales, which may vary across individuals. How are the dynamic activities of several physiological systems related to the experience, expression, and understanding of one or more emotions, and to the regulation of those emotions within the context of the stimulus that is eliciting those emotions, for an individual of a given age with a given history of relationships and experiences? How have these features developed over one's past and how are they expected to develop across the ensuing months and years?

If you have made, or if you aspire to make, the study of the psychophysiology of emotional development into your career, these questions may excite you, or they might have you wondering about the physiological concomitants of despair and hopelessness. Given the complexity of these questions, it may not be surprising to learn that there has been little if any theory or research that has addressed all of their features in an integrated and systematic way. Each element is sufficiently complex to have generated its own body of ongoing scientific investigation. For example, many scholars of emotional development have constrained their efforts to the study of central tendencies—age-related changes in the average, typical, or "mean" affective phenomenon that they study—whereas others have concentrated on examining the determinants, breadth, or sequelae of individual differences in the development of that affective phenomenon (Pérez-Edgar & Hastings, 2018). Similarly, until quite recently, most scholars of emotional psychophysiology have studied one biological system—for example, *either* the brain *or* the autonomic nervous system—rather than studying how the relations between them are involved in emotions (Hastings, Buss, & Dennis, 2012). Thus, the absence of a "grand unifying theory" of the neurobiology of emotional development has not forestalled the progress of essential and informative research. In this chapter, we consider germinal and recent work by ourselves and others that has shaped or reflects our own current perspective on developmental affective psychophysiology, and we attempt to suggest some connecting threads that may inform the next wave of research in this challenging, complex, and exciting area.

We begin by presenting an overview of the autonomic nervous system (ANS), which has been studied most often in research on emotional development and which has been the primary focus of our research, and a more succinct review of the hypothalamic-pituitary-adrenal (HPA) axis system. There are other physiological systems that are critical to emotional functioning and have been examined in studies of emotional development. We touch on some of these in describing specific studies, but for more detailed information on these other systems, readers are referred to recent reviews by ourselves (Hastings & Guyer, 2014; Hastings, Kahle, & Han, 2014) and others (e.g., Zisner & Beauchaine, 2016). Of course, all of these systems are intricately interrelated with neural activity within the central nervous system (CNS). Although we consider some aspects of brain structure and function within this chapter, readers are directed to the chapter by Fox (this volume) for a much fuller treatment.

We then introduce a set of five overarching themes and fundamental issues that need to be considered when studying the psychophysiology of emotional development. To greater and lesser degrees, theorists and researchers in this field have been engaging with these challenges for decades. To an extent, they are reflections of the elements that collectively could give rise to a "grand unifying theory" of emotional development. We don't claim to be anywhere close to proposing such a theory, but like many other developmental scientists, we have been attempting to incorporate these themes and issues into our studies with children, youths, and families for several years. Examples of how we and others have done so, and what has been learned from these efforts, are in the pages that follow.

The Autonomic Nervous System

Given that functional and evolutionary theories of emotion suggest that emotions serve to prepare the body to respond adaptively to personally relevant stimuli, emotional experiences should involve concomitant physiological and somatic changes. As the rapid route of bidirectional communication between the brain and the viscera of the body, the ANS is critical for preparing the muscles and organs of the body to rapidly respond to evocative stimuli (Berntson, Quigley, & Lozano, 2007), including as part of coordinated emotional responses. With afferent and efferent fibers carrying information between the brain and body, examining activity of the ANS may provide an indirect window into the CNS and processes of perception, attention, and appraisal (Critchley, 2005; Porges, 2007), including interoception or self-awareness of somatic states during affective experiences (Smith, Thayer, Khalsa, & Lane, 2017). The nerves that constitute the parasympathetic (PNS) and sympathetic (SNS) branches of the ANS extend into the body from the nucleus ambiguus and spinal cord, respectively, but these brainstem and spinal systems are interconnected with a network of subcortical and cortical regions that both regulate and respond to ANS activity. The amygdala and limbic system, and multiple regions within the medial prefrontal cortex (mPFC), are particularly important in this network (Thayer, Ahs, Fredrikson, Sollers, & Wager, 2012), although to date there has been little investigation of how such brain-body or neurovisceral functioning develops in the years before adulthood (Miskovic & Schmidt, 2012; Weissman, Guyer, Ferrer, Robins, & Hastings, 2018).

Within the ANS, the parasympathetic and sympathetic branches work together to affect target organs. Historically, their functioning has been envisioned as operating on antagonistic or homeostatic principles, with the two branches seen as having opposing effects (Berntson & Cacioppo, 2007). As the core of one of the body's primary stress-response systems, the sympathetic-adrenal-medullary (SAM) system, the SNS is central to fight-or-flight responding and commensurate anger and fear emotions, as well as other states requiring bodily activation (Fowles, 1988). In complementary fashion, the PNS is regarded as acting to calm states of high arousal and recover from emotions like anger and fear and to promote restoration and recuperation of bodily resources. Hence, the PNS has been called the "rest and digest" system (i.e., it promotes sleep and digestion) and is associated with low-activation emotions like sadness and contentment.

Research has not supported this narrow view of reciprocal or oppositional activity, however, as the SNS and PNS can coordinate their activity in multiple ways, including simultaneous increases (coactivation) or decreases (coinhibition) (Berntson, Cacioppo, Quigley, & Fabro, 1994). Additionally, changes in the activity of one branch can produce somatic effects typically associated with the other branch, such as decreased PNS influence producing a faster heart rate without requiring increased SNS influence (Porges, 2007, 2011). Further, in accord with an allostasis framework (Berntson & Cacioppo, 2007; McEwen & Stellar, 1993), the ubiquity of rapidly changing affective stimuli that we experience in daily life necessitates a more dynamic, flexible, and nuanced integration of SNS, PNS, and CNS functioning than could be attained through a simple homeostatic model.

The SNS and PNS both innervate and influence the activity of multiple organs and tissues, and hence, not every physiological measure is effective for identifying which branch of the ANS may be responsible for the activity that is measured. For example, when anger is induced in a person, the pupils dilate, heart rate increases, and blood pressure rises (Kreibig, 2010). However, each of those somatic changes can be produced by either branch of the ANS, or by the coordinated activity of the two branches. Thus, while such indices can reveal the degree of general autonomic arousal associated with emotion, they cannot reveal the underlying neural mechanism responsible for that bodily component of an emotional state. Fortunately, there are other ways of assessing the specific activity and effects of the SNS and PNS.

The sympathetic nervous system There are multiple noninvasive methods for measuring SNS activity that are appropriate for research with infants and children, one of which—the measurement of electrodermal activity (EDA) or skin conductance—was among the earliest-developed technologies for psychophysiological research. This practical fact, combined with historically predominant interests in the fight-or-flight response and systems of approach and avoidance motivation, resulted in a longer history of research on links between the SNS and emotional development than is true for the PNS (and, not coincidentally, a larger body of research on the psychophysiology of fear and anger than is true of other emotions). EDA serves as a specific index of SNS activities because the eccrine sweat glands are innervated by the SNS exclusively; thus, perspiration produced during emotional arousal is the result of increased SNS activation (Dawson, Schell, & Filion, 2000). EDA is most often measured through skin conductance levels (SCL) on the palmar surface of the hand, or changes in the skin's overall resistance to electrical current, and skin conductance responses (SCR), which are acute, brief decreases in resistance that may occur in relation to, or independent of, specific stimuli. But sweaty skin is not the only specific indicator of SNS activity. More recently, the combination of impedance cardiography (IMP) and electrocardiography (ECG) to noninvasively measure the flow of blood through the heart during heartbeats has allowed researchers to examine a cardiac index of sympathetic activity, pre-ejection period (PEP) (Berntson et al., 2007). PEP is the elapsed time between the depolarization of the left ventricle and the opening of the aortic valve during a heartbeat. Sympathetic influence primarily modulates cardiac contractility; a shorter PEP indicates greater sympathetic influence producing greater contractility and thus faster blood flow. In addition, SNS activity can be measured through salivary alpha-amylase (sAA). Alpha-amylase is an enzyme that is secreted by the saliva glands both while eating and, through sympathetic influence, in response to stress-related psychological arousal (Granger et al., 2006; Rohleder, Wolf, Maldonado, & Kirschbaum, 2006).

It is important to note that the ability to detect changes in SNS activity through these indices unfolds across different time scales, from a matter of seconds (PEP, SCL and SCR) to minutes (sAA). Because of this, the measures are not all equally applicable to studies of all emotional phenomena. For example, sAA would not be the ideal measure of SNS activity in a study that involved showing a set of pictures of emotionally expressive faces to children.

The parasympathetic nervous system Noninvasive assessment of PNS activity can be obtained from ECG by analyzing high-frequency heart rate variability (HRV-HF). The heart does not beat at a constant rate; a resting heart rate of 60 beats per minute (bpm) does not mean that exactly 1 second passes between each beat of the heart. Rather, there are nonrandom variations in interbeat intervals, hence HRV. There are multiple sources of influence on HRV. Variability in heart rate that occurs in correspondence with the respiratory cycle—breathing—constitutes HRV-HF, and this is under the control of the myelinated vagus nerve (Berntson et al., 1997). There are several ways of statistically isolating and quantifying HRV-HF based either on frequency or temporal

parameters. The frequency domain measure respiratory sinus arrhythmia (RSA) is used most often in development literatures, although some reports have utilized one of two temporal domain measures, root mean square of successive differences (RMSSD) and standard deviation of interbeat intervals (SDNN) (Miller & Hastings, 2016).

Focusing on the more commonly used measure, higher RSA values reflect greater parasympathetic influence. The myelinated vagus nerve tonically downregulates cardiac activity by suppressing the sinoatrial node, the heart's pacemaker (Brownley, Hurwitz, & Schneiderman, 2000). In effect, because of PNS influence via the vagus nerve, one's resting heart rate is slower and more variable than it would be if the sinoatrial node could operate unchecked. There is considerable evidence that baseline or resting state RSA is associated with trait-level capacity for emotion regulation (Beauchaine, 2001, 2015), although, as we will consider in later sections, this may not be a linear association (Miller, Kahle, & Hastings, 2017). Changes in PNS influence as reflected by decreases or increases in RSA also are important for understanding multiple aspects of emotional and social functioning. In our own program of work and that of many others, understanding of the emotional and social significance of both baseline RSA and dynamic changes in RSA in response to stimuli has been heavily influenced by Porges' polyvagal theory (1995, 2007). Rather than "rest and digest," Porges has proposed that the PNS is a critical component of the social engagement system (Porges & Furman, 2011), with flexible changes in parasympathetic control over autonomic activity in response to emotion-relevant cues facilitating adaptive social behaviors (Beauchaine, 2012). When a social context is perceived as safe, mild to moderate parasympathetic augmentation (increased RSA) supports calm engagement with social partners. When events occur that are personally relevant and potentially challenging, mild parasympathetic suppression (decreased RSA) facilitates orienting and preparation for active coping without requiring sympathetic activation. In response to threatening events or cues of danger, stronger parasympathetic suppression (greater RSA decreases) opens the door for increased sympathetic activation to mobilize resources for fight-or-flight responses (Hastings, Kahle, & Han, 2014; Kahle & Hastings, 2015). There is some research with animals (e.g., Nijsen, Croiset, Diamant, De Wied, & Wiegant, 2001; Zhang, Murphy, & Feldon, 2004) suggesting that freezing responses to threats are connected to strong parasympathetic augmentation (greater RSA increases), perhaps in concert with sympathetic coactivation, but we are not aware of that having been reported in human research.

As with SNS measures, time is a consideration when working with RSA and other measures of PNS influence over cardiac activity. Computing RSA depends on identifying a specific frequency of HRV across multiple heartbeats. We and others have found that recording periods, or "epochs," with durations as brief as 15–30 seconds are sufficient for assessing RSA in children (e.g., Brooker & Buss, 2010; Miller et al., 2013), due in part to their higher heart rates and thus more frequent heartbeats within brief periods of time, relative to adolescents or adults. Recording periods of 30–60 seconds are effective for assessing RSA in adults. With time-domain measures of HRV like RMSSD, the use of shorter recording periods may be viable; for example, we have used 15-second periods with adults (Allison et al., 2012). In general, longer recording periods produce more stable measures of HRV (Berntson et al., 1997), but periods of 1 minute or longer may be more appropriate for assessments of baseline HRV than for HRV during brief emotion-related phenomena that may unfold over seconds.

The Hypothalamic-Pituitary-Adrenal (HPA) Axis System

Together with the SAM system, the HPA axis system is one of the body's primary stress response and regulation systems. Both throughout the regular diurnal cycle and in response to acute events, a coordinated network of organs within the brain and the body produce a cascade

of hormones which ultimately trigger the release of cortisol and dehydroepiandrosterone (DHEA) into the bloodstream (Gunnar & Adam, 2012; Kaltas & Chrousos, 2007). This process begins in the hypothalamus, where neurons in the paraventricular nuclei release corticotropin-releasing hormone and arginine vasopressin. These stimulate corticotrophic cells in the anterior pituitary to secrete adrenocorticotropic hormone, which crosses the blood-brain barrier and, through the circulatory system, reaches the adrenal glands. Adrenocorticotropic hormone triggers the adrenal cortex to release corticosteroids, including cortisol and DHEA, into serum, and these circulate throughout the body to affect changes in multiple targets, with cortisol eventually crossing the blood-brain barrier to bind with receptors in multiple regions. Among other effects, this signals the hypothalamus to reduce production and release of corticotropin-releasing hormone, the initial trigger of HPA axis activity, such that the HPA axis system is self-regulating through a negative feedback loop.

Among the most powerful elicitors of acute HPA axis responses—that is, event-related increases in the production of cortisol—are psychologically and personally relevant emotional stressors, including negative evaluations of the self that induce emotions like anxiety, fear, shame, and loneliness (Adam, 2012; Gunnar & Adam, 2012). These acute increases in the production and release of cortisol trigger somatic and metabolic changes that mobilize resources for active coping, including fight-or-flight arousal, along with psychological changes including heightened vigilance and attentiveness (Kaltas & Chrousos, 2007). If elevated cortisol levels persist for hours, days, or longer, however, the effects of *hypercortisolism* are neurotoxic: Low energy, flattened emotions, proneness to infection, tissue damage, and even neurostructural changes can occur.

In addition to its critical importance to adaptive functioning, one practical reason why research on the HPA axis has flourished is because it is relatively easy to assess noninvasively. As it circulates throughout the body, unbound cortisol in serum gets secreted into the saliva glands and from there into saliva. Thus, as with sAA, changes in cortisol levels can be assessed by asking children (or adolescents, or adults) to provide samples of spit. However, there is also a similar time consideration as with sAA. On average, it is not until approximately 20 minutes after the acute eliciting event that increased cortisol levels are detectable in saliva, which limits the kinds of emotional processes for which cortisol is an informative measure.

Overarching Themes and Fundamental Issues

The social contexts of emotional development Since the foundational observations and insights of Charles Darwin in *The Expression of the Emotions in Man and Animals* (1872/1999), emotions have come to be understood as essential for mammalian functioning and survival. Preserved or transformed across species and over generations, the capacities to perceive, experience, express, and regulate emotions are products of shared genetic lineages, selective pressures to survive in species-specific ecological niches, and evolved changes in neural and other biological systems. Given the greatly advanced size and complexity of their brains, the primates, including humans, arguably lead the most complex and multifaceted emotional lives of all mammalian families, including the capacity to understand, as well as perceive, the emotions of oneself and others.

As with all characteristics maintained or adapted through evolutionary processes, these biologically based emotional competencies exist because they have served to promote our effective functioning and survival within our ecological niches. The ecological niche of humans is the social group (Beckes & Coan, 2011), and the first social group we experience is the family. The family group is the primary context in which evolutionary forces have acted upon our neurophysiology and neuropsychology to shape our emotional lives (Hastings, Miller, Kahle, & Zahn-Waxler, 2014). Thus, any deep understand-

ing of the biology of human emotions needs to be built on the recognition that affective physiology is both a mechanism and a product of social interactions, and the individual ontology of emotions begins with the relationship(s) between an infant and its parent(s) or primary caregiver(s). This first social context is maintained, barring tragedy, as the growing individual experiences both more and more diverse social contexts through childhood and adolescence, and the complex neurobiology of emotions continues to both shape and be shaped in these niches.

As children broaden their social contexts and gain experience with emotions within diverse relationships and settings, it is likely that the direct links between family experiences and affective psychophysiology will seem to weaken. Rather than suggesting that there are not enduring effects of early nurturing and parental socialization on the psychophysiology of emotional development, this could indicate a developmental cascade in accord with a systems perspective (Cox, Mills-Koonce, Propper, & Gariépy, 2010). A child engages with a new social context in ways that are at least partially dependent on affective psychophysiology that has been shaped in prior social contexts. As an active agent, that child's emotional functioning influences the new emotional and social input received from the novel context and relationship partners, which in turn influences the child's emotional functioning. The continuing mutability or plasticity of the physiological and other elements of emotion therefore may be more proximally associated with the child's more recent contexts, but their experiences of those contexts were indirectly influenced by the child's earlier social contexts (within the home) that contributed to how the child was prepared to engage with subsequent social contexts (outside the home).

These proposals echo how the current lens of developmental science examines the classic discussion of nature and nurture. Nurture *is* nature, and nature *acts through* nurture. Many theories, models, mechanisms, and approaches reflect this integrative perspective, including the bioecological model (Bronfenbrenner & Ceci, 1994), organismic specificity (Wachs & Gandour, 1983), life history theory (Stearns, Allal, & Mace, 2008), differential susceptibility (Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2007), epigenetics (Meany, 2001), developmental psychopathology (Cicchetti, 2006), the dialectical unified theory (Sameroff, 2010), and others. These vary considerably in their specific emphases and, relatedly, in how they can inform the contextually embedded nature of the development of affective psychophysiology.

Our emotional lives are not linear or static Within the contexts of our social engagement with relationship partners, emotions are dynamic processes of change. Emotions are often transient, yet even over brief affective experiences, the temporal dynamics of emotions include latency to onset, duration, fluctuation of intensity, attenuation, and recovery. Logically, the chronometry of neurological and physiological activity that is part and parcel of emotions also is dynamic and nonlinear (Fox, Kirwan, & Reeb-Sutherland, 2012). However, the majority of developmental (and nondevelopmental) studies of physiology and emotion—including many of our own—have utilized research methodologies and statistical analyses that do not reflect this perspective. Rather, physiology is recorded from each participant in a condition that is considered to be neutral or non-affective, and in an emotional condition, and the average or mean levels of the participant's (and collectively, the participants') physiological activity in each condition are compared. But this static approach ignores the fact that it is unlikely that emotion is induced or experienced as a constant within the emotional condition and obscures the potentially meaningful changes in physiology within that time. Fortunately, advances in research designs and quantitative methodologies have opened the door for examining affective psychophysiology as dynamic and nonlinear processes (Brooker & Buss, 2010; Burt & Obradović, 2013; Helm, Sbarra, & Ferrer, 2012; Obradović & Boyce, 2012; Ram & Grimm, 2007).

Our emotional lives do not only encompass fleeting acute states; moods may persist for hours or days, and our affective traits—individual differences in persistent emotional tendencies—can color and shape our emotional states for months or years. Although they play out over longer windows of time, moods and traits are not static or unchanging. Physiological activity is necessarily part of these more enduring emotional phenomena as well, and there is no a priori reason to expect that these aspects of affective psychophysiology would be accurately characterized by simple linear models. For example, the fact that baseline measures of PNS activity are associated with, and may be biomarkers for, emotion regulation does not have to mean that "more is better" (Hastings, Zahn-Waxler, Robinson, Usher, & Bridges, 2000; Miller et al., 2017).

Are we studying the physiology of emotion or the physiology of emotion regulation? Emotion regulation involves modification of the dynamic features of emotional experience and expression through both automatic and intentional processes and by the efforts of both oneself and one's social partners. Emotion regulation can involve changes in the latency, duration, intensity, resolution, and appraisal or interpretation of emotion (Gross & Thompson, 2007). Whether made volitionally or automatically, effective emotion regulation involves changes in emotion that promote coping at that time, while maintaining one's longer-term goals of social integration and personal well-being (Thompson, Virmani, Waters, Raikes, & Meyer, 2013). However, emotion regulation researchers have debated whether regulation can be separated from emotion itself. In other words, it is unlikely that it is possible to measure a completely unregulated form of emotion (Thompson, 2011), and thus, there have been calls for careful consideration of exactly what it means to study both the expression and experience of *emotion* as well as the *regulation* of emotion (Cole et al., 2004).

It can be difficult to know whether any recorded feature of physiological activity is an aspect of emotion itself or an aspect of the regulation of emotion. The answer is most likely both (Cole et al., 2004). As children actively cope with ongoing emotional events, their regulatory efforts modulate their physiological activity involved with that emotion. Thus, emotion regulation actually may interfere with efforts to study emotional coherence (Levenson, 1994)—that is, the correspondence between physiology and other elements (e.g., expression, experience) of an emotion response—because any tight coupling between the physiological and other features of emotion may be disrupted by emotion regulation efforts (Butler, Gross, & Barnard, 2014). For example, physiological changes could support the suppression of emotion expression, such that one could expect the physiological changes to be more strongly associated with that self-regulation behavior than with any observable expression of the emotion. More concretely, research showing that the intensity of children's anger expression is positively associated with SNS activity (Hubbard et al., 2002; Smith, Hubbard, & Laurenceau, 2011) could suggest either that there is coherence between anger and sympathetic activation or that suppression of SNS activity is a component of children's masking of anger expression.

The literature linking emotion regulation and ANS activity has been mixed. For example, larger decreases in RSA (parasympathetic withdrawal; RSA suppression) in response to anger have been concurrently linked with emotion regulation strategies in the moment (Calkins, 1997) and prospectively found to predict trait-like characteristics indicative of better emotion regulation years later (e.g., less negativity and fewer externalizing problems; Calkins & Keane, 2004). Conversely, other studies have found that smaller decreases in RSA, or increases in RSA (maintaining or engaging parasympathetic influence; RSA augmentation), are associated with greater use of emotion regulation strategies in the moment (Davis, Quiñones-Camacho, & Buss, 2016; Musser, Galloway-Long, Frick, & Nigg, 2013; Perry, Calkins, Nelson, Leerkes, & Marcovitch, 2012) as well as better trait-level emotion regulation (Beauchaine et al., 2013). Examinations of children's sympathetic activity during negative

emotion inductions have produced similarly mixed findings. For example, increases in sAA have been associated with mothers' reports of better regulation and less negativity at the trait level (Spinrad et al., 2009), but also with less use of emotion suppression as a regulatory behavior in the moment (de Veld, Riksen-Walraven, & de Weerth, 2012) and with worse relationships with teachers (Granger et al., 2006).

Not all mechanisms or strategies for emotion regulation are appropriate or effective in every situation, and thus, children do not enact emotion regulation consistently across situations or over time. Obviously, this will influence the interpretation of any links between physiology and emotion regulation. Emotion regulation encompasses a wide range of behaviors, from rocking and other forms of physical self-soothing to cognitive reframing of events, which surely show different associations with physiology (Dan-Glauser & Gross, 2011). Emotion regulation encompasses both the downregulation (decreasing) and upregulation (increasing) of an emotional response, which likely would involve divergent aspects of physiological change (Butler et al., 2014; Gross, 1998). Thus, we should expect the relations between emotion regulation and physiology to be nuanced and complex and to be subject to the same considerations for social context, time, and dynamic chronometry as emotions themselves.

Children, emotions and physiology all develop It is reasonable to expect that the interconnections or integration of the multiple elements of emotion—physiology, experience, expression, introspection, regulation, etc.—may change with age because each element on its own evidences notable maturational changes. For example, children increase in their ability to identify and enact effective regulation strategies across the preschool years (Cole, Dennis, Smith-Simon, & Cohen, 2009), and by middle childhood, children begin using more mental strategies such as reappraising the situation, changing goals, or using mental distraction (Thompson et al., 2013). Children also learn to express and regulate emotions in the school context, which holds potentially greater regulatory challenges as well as higher social stakes than the home context (Eisenberg et al., 2005).

ANS activity changes dramatically from infancy to the preschool years to the school-age years to adolescence. Maturation is associated with greater relative parasympathetic dominance of tonic autonomic state, as older children tend to have higher RSA and longer PEP at baseline than do younger children (Alkon et al., 2003; Alkon, Boyce, Davis, & Eskenazi, 2011; Gentzler, Rottenberg, Kovacs, George, & Morey, 2012; Hinnant, Elmore-Staton, & El-Sheikh, 2011; Matthews, Salomon, Kenyon, & Allen, 2002). Parasympathetic reactivity appears to diminish with age, such that younger children show stronger RSA suppression than older children (Alkon et al., 2003; Calkins & Keane, 2004; El-Sheikh, 2005). Several studies have found that PEP reactivity increases (greater shortening of PEP in response to challenge) over early and middle childhood (Allen & Matthews, 1997; Matthews et al., 2002; Quigley & Stifter, 2006), and children and adolescents show stronger skin conductance responses to emotional stimuli than do adults (Shields, 1983). However, decreases in sympathetic activity over childhood development have also been reported (Alkon et al., 2011; El-Sheikh, Keiley, & Hinnant, 2010).

Yet in addition to these developmental changes, there is also stability. Children maintain their rank order over time for some of these metrics—for example, both mother-reported emotion regulation and baseline autonomic activity are moderately stable across childhood (Blandon, Calkins, Keane, & O'Brien, 2008; Eisenberg et al., 2003; Murphy, Eisenberg, Fabes, Shepard, & Guthrie, 1999; Raffaelli, Crockett, & Shen, 2005; Venables & Mitchell, 1996). It is plausible that the stability of individual differences in the development of emotional psychophysiology might be intertwined with the stability of individual differences in other aspects of emotional functioning, such as temperament (see Perez-Edgar, this volume). However, autonomic reactivity (at least, as assessed using static change scores) is notably low in stability across childhood (Alkon et al., 2011; Calkins & Keane, 2004;

El-Sheikh, 2005; Salomon, 2005). It is intriguing to consider whether and how nonstable autonomic reactivity may contribute to individual differences in emotional characteristics that are more stable.

Similarly, although the HPA axis system develops rapidly and is active in infancy, there are developmental changes in its functioning. The early to middle childhood years are a period of *hyporesponsivity* for the HPA axis (Gunnar & Quevedo, 2007). Compared to infants, adolescents, and adults, it can be challenging to elicit a large increase in circulating cortisol levels in kindergarten and elementary school-aged children (Gunnar, Talge, & Herrera, 2009). Perhaps young children truly are less responsive to stress, or perhaps researchers have not identified appropriate stressors to use in studies of young children. Either way, it is clear that basal cortisol levels rise over childhood, and as children begin to approach adolescence, their HPA axis responses to stressful events also strengthen. In fact, adolescence is marked by *hyperresponsivity* of the HPA axis, relative to childhood and adulthood (Dahl & Gunnar, 2009; Gunnar et al., 2009), which may be related to adolescents' heightened awareness of and concerns about social evaluative situations and contexts.

Thus, in addition to expecting that there may be context-specific links between emotion and physiology, we should also expect that links may be specific to developmental periods. Less versus more mature or cognitively demanding forms of emotion regulation skills may be supported by different patterns of autonomic activity, and the physiological features of a given emotion regulation behavior may change over maturation as that behavior progresses from being developmentally normative at younger ages to being developmentally atypical and possibly inappropriate at older ages. Relatively little is known about how maturation impacts the associations between physiology and emotion or emotion regulation because there have been few studies that included repeated measures of both constructs across ages.

Feeling all the feels There is a long history of debate regarding whether there are (Rainville, Bechara, Naqvi, & Damasio, 2006; Vytal & Hamann, 2010) or are not (Lindquist, Wager, Kober, Bliss-Moreau, & Barrett, 2012) patterns of distinct physiological and neurological activity that correspond with specific emotion states like anger, fear, sadness, and joy. Much of the research informing this debate has been based on physiological recording during rigorously standardized procedures designed to elicit one specific emotion state (or, one per condition). Yet, emotional stimuli are rarely if ever completely unambiguous. Even the most carefully selected emotional stimuli have a degree of complexity, and individual differences between participants can affect not only the intensity of emotion experience but also the variety of emotions experienced. Thus, when researchers choose to measure whether emotions other than the intended one were experienced, it is typical for them to find that some participants report some degree of nontargeted emotional experience (Gross & Levenson, 1995; Lewis, Sullivan, & Kim, 2015).

When children experience a goal being blocked, anger is the typically expected response and is thought to motivate continued effort to attain the goal (Fridja, 1986; Lemerise & Harper, 2010). However, some children experience sadness instead of, or *in addition to*, anger. Sadness in this context has been suggested to reflect the perceived absence of control, or giving up (Lewis, Ramsay, & Sullivan, 2006), and could be considered to be less adaptive in terms of motivating persistence in the face of frustration (Dennis, Cole, Wiggins, Cohen, & Zalewski, 2009). But another putative function of children expressing sadness is to seek social support or help (Buss & Kiel, 2004; Zeman & Shipman, 1996). Thus, children may vary in the valence, number, and goals of their experienced emotions in response to a given laboratory procedure.

In the "real world" of naturally occurring affective cues within social contexts, the simultaneous experience of multiple emotions is undoubtedly even more common. An essential aspect of children's healthy emotional competence is being able to experience the full spectrum of emotions (Denham, 1998; Saarni, 1999).

Yet recognizing that it may be normative to feel multiple emotions simultaneously, to varying degrees, adds yet another level of complexity to our efforts to understand the psychophysiology of emotional development.

Relatedly, even a single given emotion comes in many shades or flavors. Imagine a young child on three occasions: In attempting to sneak a cookie before dinner, she breaks her parent's favorite coffee mug; upon arriving at school, she sees an older bully between her and the door; after staring enchanted at a pet store window, she turns and, instead of seeing her family, she sees a crowd of strangers filling the shopping mall. One might expect that in each of these situations, the child would feel "fear"—respectively, fear of potential punishment (and perhaps also guilt); fear of imminent harm (and perhaps also indignation at injustice); fear of separation and the unfamiliar (and perhaps looming panic). Just as the subjective experience of fear would likely be a little different in each case, so too could be the other affective components, including physiology. Across these varying social contexts, would consistency in the physiology of emotion be adaptive, or should the biological aspects of an emotion be expected to change as the setting conditions for that emotion change? Assuming the latter, as developmental scientists we expect that there are some predictable parameters that govern that variation, such that the physiology of fear would vary in accord with how the specifics of the context (e.g., home and family; school and peers; mall and strangers) and the evocative stimuli (e.g., transgression; aggressor; separation) combine with the general (e.g., age; gender) and specific (e.g., temperament; attachment status) characteristics of that child.

Recent, Current, and Future Directions in the Psychophysiology of Emotional Development

Getting bent: Nonlinear models of the psychophysiology of emotional development In 2010, Brooker and Buss made an important demonstration of the insights that can be drawn by examining patterns of physiological change *within* an emotion-inducing activity. They showed that temperamentally fearful and nonfearful toddlers differed in their patterns of parasympathetic activity when approached by a friendly male stranger for 2 minutes in a laboratory playroom. RSA was lower (parasympathetic withdrawal) in the stranger approach condition than that at baseline for both groups of toddlers; whereas nonfearful toddlers maintained a steady level of PNS activity over the 2 minutes, fearful toddlers had an initial small increase in RSA followed by a sharp decrease as the stranger went closer (Brooker & Buss, 2010). This quadratic pattern of RSA change may have been adaptive or reflected effective regulation for the fearful toddlers, though, as it was associated with their positive affect expression.

Brooker and Buss (2010) were able to identify that trait (fearful temperament) and state (positive affect) aspects of emotionality were related to a nonlinear pattern of changing physiological activity because, rather than examining average RSA across the 2-minute task, they treated RSA as a repeated-measures variable, with RSA computed for each of four consecutive 30-second periods or epochs. We have followed a similar strategy to examine children's affective psychophysiology during several emotion induction procedures. For example, the Mood Induction Stimulus for Children (MISC; Cole, Jordan, & Zahn-Waxler, 1990) is a narrated comic-strip style series of vignettes of a child going through situations that cause the child to feel various emotions. Each vignette lasts 60 seconds, with a mildly positive 15-second introduction, a provocative event and initiation of the child's emotion (with accompanying music) for 15 seconds (e.g., the child's dog runs away; sadness), intensification of the emotion for 15 seconds, and then a mildly positive resolution for 15 seconds. Using piecewise latent growth curve modeling (Grimm, Ram, & Hamagami, 2011), we have shown that a nonlinear latent slope reflecting RSA suppression from the first to second epoch (emotion introduction) followed by RSA augmentation in the third epoch (emotion intensification), and little change

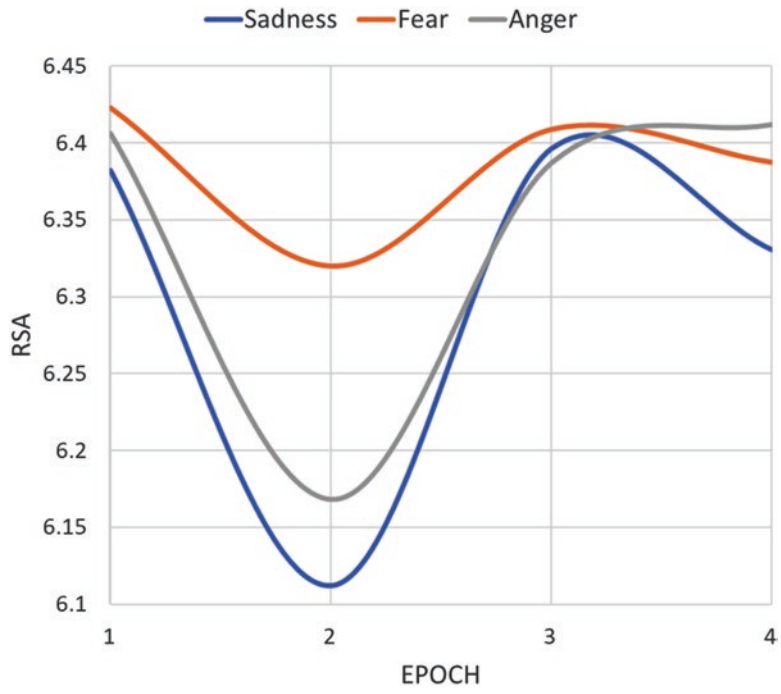

Fig. 1 The average trajectories of children's nonlinear latent slope of parasympathetic regulation of cardiac activity while watching scenarios of a child experiencing and expressing sadness, fear, and anger (Ugarte et al., 2019). RSA respiratory sinus arrhythmia. E epoch, 15 seconds. Negative emotion is first expressed in E2 and increases in E3. E1 and E4 are mildly positive introductions and resolutions

in the fourth epoch characterizes 4- to 6-year-old children's parasympathetic activity while watching scenes of anger (Miller et al., 2013), sadness (Miller, Nuselovici, & Hastings, 2016), and fear (Ugarte, Miller, Weissman, & Hastings, 2019) (see Fig. 1).

This described the average latent RSA slopes. There was also significant variability in the magnitude of children's slopes, and this variability was associated with children's emotional characteristics and behavioral self-regulation. We first (Miller et al., 2013) found that stronger latent slopes for RSA during the anger vignette (more suppression followed by more augmentation) were more characteristic of children who (a) reported that they were less likely to respond to peer provocation with aggressive behavior and (b) were female and older, both of which are robustly associated with better emotion regulation (Keenan & Shaw, 1997; Lemerise & Dodge, 2008). These associations were weak or nonsignificant for the specific component of PNS change, the initial RSA decrease, and the subsequent RSA increase, indicating that it was the overall process of flexible parasympathetic activity that conveyed the effects. We then (Miller et al., 2016) found that stronger latent RSA slopes across two sadness vignettes (a) were associated with children being more likely to report feeling sad while watching the vignettes, indicative of affective empathy, (b) were indirectly associated, through empathic sadness, with children's prosocial and sympathetic responses to adults' simulations of distress, and (c) directly predicted increases in children's prosocial responses to adults' simulations of distress over the subsequent 2 years. Notably, the latent RSA slopes for anger and sadness were correlated, potentially suggestive of an underlying trait for parasympathetic regulation during emotion, but there was no cross-affect association with behavior (Hastings, Kahle, & Han, 2014). The latent slope for anger did not predict empathic sadness, sympathy, or prosocial behavior, and the latent slope for sadness did not predict self-control of aggression, suggesting that there was specificity in the links between emotion, physiology, and behavior.

Most recently, using factor of curves (FOCUS) modeling (McArdle & Epstein, 1987), we demonstrated that the nonlinear latent RSA slopes for anger, sadness, and fear could be

characterized by an underlying structure that was common to the three emotions (Ugarte et al., 2019; Fig. 1). Again indicative of a trait-level regulatory capacity, we have labeled this pattern of disengaging and engaging PNS control "vagal flexibility" (Miller & Hastings, 2016). Anchored in the polyvagal theory (Porges, 2007; Porges & Furman, 2011), we interpret the initial decrease in RSA—commonly called withdrawal or suppression—to be reflective of parasympathetic support for an orienting response toward the salient cue of negative emotion. As the narrative continues, the following increase in RSA—augmentation—would reflect parasympathetic support for social engagement. The depicted emotion is not personally challenging or threatening, and thus, an active coping response is not needed. Rather, after initially orienting to the stimulus, subsequent physiological calming of autonomic state would help the child to monitor and be receptive to the emotional state of another child (in this case, a fictional proxy for a social partner).

One implication of this interpretation is that emotion researchers may need to think carefully about what they are actually measuring when they use story narratives or movie scenes to "induce" emotional states. These are widely used procedures with children and adults alike, with a carefully selected set of the same scenes being used by many laboratories (Hastings et al., 2009; Rottenberg, Ray, & Gross, 2007). The procedure typically elicits facial expression of emotions and self-reported subjective feelings, as well as physiological reactivity. But to what extent does the physiological reactivity reflect an aspect of an individual's vicariously induced emotional state(s), versus an individual's observation, evaluation, and preparedness to engage with social partners who are experiencing emotion?

One could argue that a reasonable alternative explanation for observing the common latent RSA slope across three narrated stories is that this is just what happens when young children watch vignettes of 60 seconds duration, regardless of the content. Although plausible, this hypothesis is refuted by the fact that a nonlinear latent slope of suppression followed by augmentation does *not* characterize children's RSA while watching the MISC depiction of a happy event (unpublished data). Watching another child experience a good thing that provokes feeling happy does not, and would not need to, evoke the same kind of orienting and assessment response as adverse events that produce negative emotions. Further, Cui and colleagues (2015) found that a similar nonlinear latent slope of RSA suppression followed by RSA augmentation characterized adolescents' parasympathetic activity while first describing, and then working through, an anger topic with a parent. This slope was associated with adolescents' self-reported emotion regulation and prosocial behavior. Finally, Miller (2018) observed a nonlinear slope of RSA suppression and augmentation in adults while watching a 2.5-minute sadness-inducing video clip. Therefore, the nonlinear latent RSA slope we identified is not specific to age, emotion induction procedure, or laboratory but may be specific to parasympathetic regulation while engaging with negative emotional information. Whether it also characterizes PNS activity during activities that are directly evoking personally experienced negative emotions is an open question, and as we consider shortly, it may not.

In case these arguments have not yet convinced you to get bent with your examinations of affective psychophysiological data, consider that even if a physiological measure or process itself is not characterized by a nonlinear pattern, its association with other aspects of emotion and behavior may be nonlinear. This has been a focus of our work on baseline RSA and children's empathy, sympathy, and prosocial behavior. Baseline parasympathetic activity may be a biomarker for emotion regulation because it is indicative of individuals' physiological capacities for managing attentional control and for coping with potentially stressful negative stimuli (Porges, 2011; Thayer et al., 2012). For children with low baseline RSA, seeing another in distress may elicit too much vicarious arousal of personally experienced distress, which would interfere with their ability to focus on the needs of the other. However, some degree of arousal when perceiving another's distress may be a necessary component of

empathy and motivator of sympathy (de Waal, 2008). We have argued that at the other extreme, children with higher baseline RSA may have such a high threshold for arousal that mild to moderate distress in others—such as a sad facial expression—is not sufficient to evoke this arousal, and hence, they may appear to be less sympathetic or prosocial (Hastings et al., 2000; Hastings, Zahn-Waxler, & McShane, 2006). This would suggest that individuals with moderate levels of baseline PNS activity would be more empathic, sympathetic, and prosocial than would those with either lower or higher baseline PNS activity, which would be a quadratic nonlinear association. Indeed, this is precisely what was reported by Kogan and colleagues (2014) in their studies of adults. We then examined this in three samples of children from 2–7 years, and in all three, we observed this quadratic pattern (Miller et al., 2017). Both concurrently and prospectively, having moderate baseline RSA was associated with and predictive of greater empathy, sympathy, and prosocial behavior, relative to both lower and higher RSA, across a variety of observed, self-reported, and adult-reported measures.

A similar set of observations can be made about adrenocortical activity. It is typically the case that emotionally challenging experiences evoke acute HPA reactivity characterized by increases in salivary cortisol levels from before to about 20 minutes after the stressor (Gunnar & Adam, 2012). Mounting a HPA response to a personally relevant challenge is a normal component of a healthy stress response, but what is the optimal amount of responsivity to support adaptive functioning? Compared to emotionally healthy individuals, individuals with affective psychopathology have been characterized as manifesting either blunted (hypo) reactivity or exaggerated (hyper) reactivity (Jollant, Lawrence, Olié, Guillaume, & Courtet, 2011; Stansbury & Gunnar, 1994). There is some evidence that hypo- versus hyperreactivity may be related to distinct aspects of psychopathology (Moss, Vanyukov, & Martin, 1995). We found that mothers reported more internalizing problems in adolescents who showed HPA hyperreactivity to an anger-induction task but more of both externalizing and internalizing problems in adolescents who showed hyporeactivity, compared to youths with more moderate HPA responses (Klimes-Dougan, Hastings, Granger, Usher, & Zahn-Waxler, 2001). However, deviations of blunted and exaggerated reactivity also have been found to be associated with the same problems. In a study of adolescent girls with elevated depression (Giletta et al., 2015), compared to girls who showed moderate HPA reactivity to an anxiety provocation, girls with either HPA hyperactivity or HPA hyporeactivity were more likely to report suicidal ideation over the subsequent 3 months.

Thus, there may be "too much of a good thing," as well as too little, when it comes to aspects of affective psychophysiology like baseline RSA and HPA reactivity. At least, this appears to be the case for some aspects of emotional functioning. Although this was evident for baseline PNS activity with respect to engaging positive, other-oriented, empathy-related responses, it might not be the case for other phenomena that have been associated with baseline RSA, such as regulation of fear and anger, or executive function during challenging tasks (Marcovitch et al., 2010), for which the personal relevance of the eliciting cue may be clearer and therefore above the threshold for arousal that may exist for individuals with higher baseline RSA. We have observed that adolescents mount distinct and unrelated profiles of HPA reactivity and recovery to an anger-induction task versus an anxiety-induction task (Klimes-Dougan et al., 2001), suggesting that different children may evidence a similar (or at least, superficially similar) physiological change in response to distinct affective contexts. The study of the psychophysiology of emotional development would benefit from greater attention to the possibility that any given aspect of physiological activity may not just be significantly versus nonsignificantly associated with affective processes but actually may be related to multiple emotional phenomena through different patterns of associations.

Regulating well and being well-regulated In another line of inquiry, we examined 3.5-year-old children's patterns of autonomic reactivity during

a task designed to elicit frustration and their recovery from this provocation after it had ended. Using the impossibly perfect circles task (Goldsmith & Rothbart, 1996), the experimenter asked the child to draw "a perfect green circle" but rejected every effort for approximately 3 minutes, then praised the final circle and encouraged the child to turn it into a drawing. As anger is an activating emotion linked to fight-or-flight responding, we expected to see SNS engagement during this task, which we assessed with repeated measures of PEP within the two phases of this task. Unlike the examination of RSA during narrative emotional vignettes, latent basis growth curve modeling of PEP conformed to patterns of linear change: PEP significantly shortened during the provocation, indicating increasing sympathetic activity, and then PEP nonsignificantly lengthened during the reparation period, indicating slightly decreasing sympathetic activity (Kahle, Miller, Lopez, & Hastings, 2016). Identifying linear rather than nonlinear physiological change was not specific to our examination of sympathetic activity rather than parasympathetic; there also was a linear pattern of parasympathetic withdrawal, or progressively decreasing RSA, that began in the provocation period and *continued* through the reparation period (Kahle, Miller, Helm, & Hastings, 2018). Perhaps linear change in both branches of the ANS occurred because children were the direct targets of anger induction rather than the vicarious witnesses of it; that is an open question.

As observed with the nonlinear RSA slopes, though, there were individual differences in these linear slopes of PEP and RSA. Mothers' reports of how emotionally well-regulated the children typically tended to be were associated with the PEP recovery slope only (Kahle, 2017; Kahle et al., 2016). Although children's autonomic arousal while an experimenter deliberately provoked angry feelings was unrelated to their trait emotion regulation, more emotionally well-regulated children had greater PEP lengthening—meaning they recovered more from their sympathetic arousal—after the experimenter stopped being a jerk and tried to make amends by praising the child's efforts.

Children's physiological recovery from emotional arousal has received much less attention than their physiological reactivity to emotion induction (Santucci et al., 2008; Willemen, Schuengel, & Koot, 2009), but an important aspect of regulating emotion is being able to end the components of the emotional experience when a situation has changed and the emotion is no longer appropriate to the context. It is normative for children to become somewhat "worked up"—autonomic activation—when angry (Kreibig, 2010). Given that small to moderate degrees of angry reactivity could be seen as context-appropriate in situations like the impossibly perfect circles task (Cole et al., 2004), parents may not have seen the magnitude of angry reactivity in such situations as being particularly indicative of a given child's self-regulatory capacity. Remaining physiologically primed for continued fight-or-flight responding after someone has made conciliatory gestures, though, could interfere with a child's ability to shift into positive social engagement behaviors. A child's inability to calm down and perseveration of negative emotional arousal could be very salient to parents.

Yet, to what extent were the preschoolers actually angry and engaged in regulatory behaviors during the task, and how were their state emotions and emotion regulation related to their physiological activity? Anger during the provocation was the strongest emotion displayed by children; it was more prevalent and evident than sadness or happiness, and anger expression lessened when the experimenter made reparations (Kahle, 2017; Kahle et al., 2018). In addition, many children engaged in self-regulatory behaviors; attention diversion or self-distraction (e.g., looking away; scribbling) was most common, with self-soothing (e.g., touching mouth; stroking arm) and positive verbalizations (e.g., reframing the task) occurring to lesser degrees. There was not significant emotional coherence between expressed emotion and PEP or RSA slopes; rather, physiology was related to regulatory behaviors. Children's uses of attention diversion and verbalizations during provocation were associated with their SNS reactivity and recovery

(Kahle et al., 2018). And although attention diversion and verbalizations were positively associated with each other—children who did more of one regulatory behavior also tended to do more of the other—these behaviors were related to sympathetic activity in polar opposite ways.

As portrayed in Fig. 2a, children who engaged in relatively more attention diversion activities during the provocation evidenced less concurrent PEP shortening—less SNS arousal—suggesting that the regulatory behavior was effective for diminishing arousal. This immediate benefit appeared to have a subsequent cost, though, as attention diversion predicted more PEP shortening—increasing SNS arousal—during the reparation phase. Children who used less attention diversion during provocation were more sympathetically activated by the task but subsequently showed greater sympathetic recovery. Conversely, as portrayed in Fig. 2b, greater use of verbalization was concurrently associated with more sympathetic reactivity during provocation and predicted more sympathetic recovery during reparation, whereas making fewer verbalizations was linked with less SNS reactivity and less recovery (delayed SNS activation) (Kahle et al., 2018).

Recall that we had previously linked greater sympathetic activation during the recovery period to poorer trait emotion regulation (Kahle et al., 2016). Thus, preschoolers for whom their state emotion regulation behavior consisted of less attention diversion and more positive verbalizations evidenced a pattern of subsequent sympathetic calming associated with better trait emotion regulation. Linking in-the-moment affective psychophysiology and regulatory behaviors with more typical emotion regulation, and thereby bridging state and trait, is one way by which we can begin to learn how regulating well and being well-regulated are connected during emotional development.

The preschool period is a time of rapid changes in the diversity and effectiveness of children's emotional self-regulation (Lemerise & Dodge, 2008), and although attention diversion is common (Stansbury & Sigman, 2000), it may become less effective and developmentally appropriate as children's capacities for engagement and cognitive reappraisal increase (Lengua & Sandler, 1996; Valiente, Lemery-Chalfant, & Swanson, 2009). Attention diversion is a disengagement strategy; while it may help to soothe states of arousal in the moment, children who habitually disengage from challenging activities may be deprived of opportunities to learn ways in which they can cope with challenges more effectively, such that these activities would become more stressful over time. Indeed, in following these children for 2.5 years and administering another age-appropriate frustration task when they were 6 years old, we found that attention diversion at preschool-age predicted autonomic physiology at early elementary school-age (Kahle, Miller, Troxel, & Hastings, unpublished). Greater use of attention diversion in response to provocation at 3.5 years predicted shorter PEP—more SNS arousal—at the start of the provocation at 6 years and also greater decreases in RSA, more PNS arousal, over the course of the provocation. Children appear to shape the development of their own affective psychophysiology through their behavioral responses to emotional stimuli and contexts, which may be one mechanism for the stability of adaptive versus maladaptive emotion regulation over time.

The nurtured nature of emotional psychophysiology Children's developing affective psychophysiology is not only influenced by their own actions; the socialization they experience in their close relationships affects children's physiology, as well as their behaviors, thoughts, and subjective feelings. We observed this in a brief longitudinal study, in which more negative, critical, and restrictive behaviors by mothers (but not fathers) predicted stronger RSA decreases (parasympathetic suppression) in preschoolers when meeting unfamiliar peers compared to a preceding baseline with the parent, suggesting the preschoolers reacted to the novel social context as potentially challenging or threatening (Hastings, Nuselovici et al., 2008). Conversely, mothers who used little negative, critical, and restrictive parenting behaviors with their children had preschoolers who

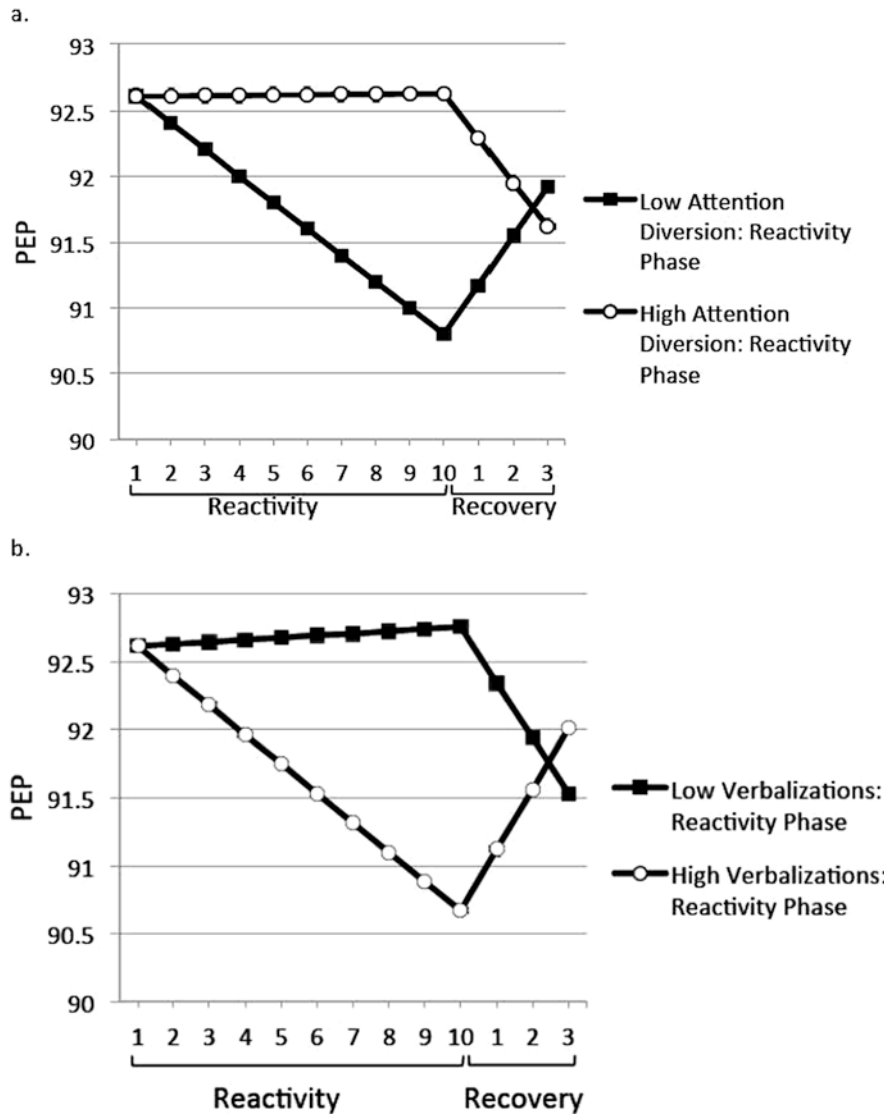

Fig. 2 Preschoolers' regulation of anger by more frequently diverting attention away from a frustrating task (**a**) and less frequently making positive verbalizations (**b**) was associated with less sympathetic activation during the activity (reactivity phase) but predicted increased sympathetic activation after the provocation ended (recovery phase) (Kahle et al., 2018). Note: PEP pre-ejection period

evidenced moderate RSA increases (parasympathetic augmentation), suggesting they were physiologically prepared for calm, positive social engagement. Further, preschoolers' greater RSA suppression to the unfamiliar peer context mediated the prospective link between mothers' negative, critical, and restrictive behaviors and children's worse behavioral self-regulation and elevated externalizing problems. Thus, in accord with a cascade model (Cox et al., 2010), socialization by mothers predicted preschool-aged children's developing parasympathetic regulation, which in turn predicted their behavioral tendencies.

Other developmental scientists have also utilized longitudinal research designs to demonstrate that variations in parental socialization

practices predict the development of children's baseline and reactive autonomic physiology (Calkins, Graziano, Berdan, Keane, & Degnan, 2008; Katz & Rigterink, 2012; Perry et al., 2012). Even stronger evidence for the socialization of emotional physiology has come from demonstrations that changes in parenting behaviors resulting from parent-training intervention also predict changes in children's physiology. With families of preschool-aged children born premature and evidencing externalizing problems (Graziano, Bagner, Sheinkopf, Vohr, & Lester, 2012), the extent to which mothers increased their positive behaviors over the course of treatment predicted increases, from pre- to post-treatment, in children's RSA suppression to a clean-up task, suggesting that the improvements in maternal parenting predicted children becoming more physiologically prepared to actively engage with the task. With families of preschool-aged children with attention-deficit hyperactivity disorder (Bell, Shader, Webster-Stratton, Reid, & Beauchaine, 2018), the extent to which mothers decreased their negative behaviors predicted increases, from pre- to post-treatment, in children's baseline RSA and PEP reactivity (i.e., shorter PEP) to a positively valenced matching task that earned them rewards, potentially indicative of improvements in both parasympathetic capacity for emotion regulation and sympathetic engagement with an emotional activity that challenged the children's attentional capacities. These studies offer powerful evidence for the argument that parenting "gets under the skin" to shape children's developing affective psychophysiology.

Yet, they fall short of providing *causal* evidence for the effects of parental socialization on children's autonomic physiology. Because neither of these studies (Bell et al., 2018; Graziano et al., 2012) included randomization of families to intervention and control conditions, and comparison of autonomic physiology in children of parents who did versus did not receive the parent-training program, neither of them met the criteria for being a true experiment. Recently, we reported on the first such study (Hastings et al., 2018), with parents who had been referred to Child Protection Services for maltreatment of their toddlers and were randomly assigned to receive either standard resource and referral services or a 10-week home visit parent-training intervention; toddlers' baseline and reactive parasympathetic activity was assessed more than 6 months after completion of treatment. Following treatment, parents who received the intervention were more sensitive, responsive, and knowledgeable about toddlers' social-emotional needs than were parents in the comparison condition (Oxford, Spieker, Lohr, & Fleming, 2016). We showed that toddlers of parents who received the intervention showed milder PNS reactivity (smaller RSA decreases) in response to five activities than did toddlers of parents in the comparison condition (Hastings, Kahle, et al., 2018). More specifically, we measured toddlers' RSA at baseline and while playing with puppets, being taught an activity, and solving a difficult puzzle with mother, and while seeing a large, jumping spider (fear induction) and being given a treat in a sealed container (frustration induction) without mother. Toddlers of parents in the comparison condition displayed strong decreases in RSA indicative of preparation for fight-or-flight responding, whereas toddlers of parents who received the intervention had the pattern of modest PNS activation that facilitates orienting to personally relevant stimuli. Furthermore, this pattern of small decreases in RSA to the five activities was most characteristic of toddlers of parents in the intervention condition who displayed the greatest sensitivity and responsiveness in the 6 months following treatment. Demonstrating that an intervention that improves parents' effective and appropriate behaviors with their toddlers also predicts children's well-regulated parasympathetic responses to emotional challenges is clear evidence for the effects of parents on young children's developing neurobiological capacities for emotion regulation.

Of course, evidence for the direct effects of parenting on children's developing emotional psychophysiology is just one example of the ways in which the integrated and transactional interplay between nature and nurture can be manifested. There has been growing interest in understanding how the synchrony, or moment-to

moment temporal correspondence, of a parent's and a child's physiological activity during interactions may contribute to the parent-child dyad's relationship quality and the child's emotional development (Feldman, 2012; Giuliano, Skowron, & Berkman, 2015; Lunkenheimer, Busuito, Brown, & Skowron, 2018; Suveg, Shaffer, & Davis, 2016). Generally speaking, greater physiological synchrony in infancy and early childhood is thought to reflect a process of coregulation in which the child begins to acquire physiological self-regulatory abilities through the scaffolding influence of the parent's physiology. We have found that the synchrony of autonomic activity in mother-preschooler dyads, as measured through continuously recorded heart rate, is greater in dyads with a more secure attachment relationship (Helm, Miller, Kahle, Troxel, & Hastings, 2018), suggesting that establishing greater synchrony may be one of the mechanisms by which attachment security confers its many benefits on children's emotional well-being. Examining continuously recorded RSA, we observed that mothers and children expressed more sadness if they were in dyads which evidenced negative synchrony, or higher RSA in one partner being concurrently associated with lower RSA in the other partner, and that negative synchrony characterized dyads in which the mother had a history of depression compared to positive synchrony in dyads of mothers without depression (Woody, Feurer, Sosoo, Hastings, & Gibb, 2016). Thus, negative synchrony appears to be a physiological aspect of the disruption to mother-child relationship quality that may be caused by maternal depression and may be involved in the intergenerational risk for transmission of depressed affect.

Similarly, in response to long-standing calls for greater consideration of models and processes of bidirectional socialization (Bell, 1968; Belsky, 1984; Lerner, 2002), some researchers have presented evidence that children's affective psychophysiology predicts the development of their parents' child-rearing behaviors (Perry et al., 2014). In two samples, we reported that toddlers and preschoolers with higher baseline RSA had parents who become more supportive, less restrictive, and more positively responsive to children's sad and anxious emotions over the subsequent 1–2 years (Hastings, Grady, & Barrieau, 2018; Kennedy, Rubin, Hastings, & Maisel, 2004). The studies suggest that children's affective psychophysiology may elicit the socialization experiences that also contribute to emotional development but in ways that reflect both virtuous and vicious circles. Young children with lower baseline RSA, indicative of less parasympathetic capacity for emotion regulation, subsequently experience more restrictive and less supportive parenting, which would be likely to further undermine the children's emotional well-being. Conversely, those with higher baseline RSA experience more positive and less aversive care-giving from parents, which would further bolster their emotional competence and well-being.

Another line of work arises from the multiple theories and models that have drawn attention to the importance of examining individual differences in both affective psychophysiology and socialization experiences within biopsychosocial models of development (e.g., Ellis, Boyce, Belsky, Bakermans-Kranenburg, & van Ijzendoorn, 2011; Hankin & Abela, 2005; Sapolsky, 2004). We have seen that children's autonomic physiology at baseline and in response to emotional stimuli often moderates the associations between parenting and aspects of children's emotions, behaviors, and adjustment (Hastings, Sullivan et al., 2008; Hastings & De, 2008; Hastings, Kahle, & Nuselovici, 2014; Hastings, Klimes-Dougan, Kendziora, Brand, & Zahn-Waxler, 2014; Miller & Hastings, 2016; Wagner, Hastings, & Rubn, 2018), as have others (Breaux, McQuade, Harvey, & Zakarian, 2018; El-Sheikh & Whitson, 2006; Sturge-Apple, Davies, Cicchetti, & Manning, 2012). Although collectively such studies indicate that some children may be more biologically prone than are other children to have some aspects of socialization influence some aspects of their development, to date, there has been little consistency across studies in exactly how such biopsychosocial moderation effects play out. Additional theoretical and empirical work is needed to advance our

understanding of the developmental, temporal, contextual, and other parameters that determine whether a given moderation effect should be expected to conform to differential susceptibility, diathesis-stress, organismic specificity, or another biopsychosocial model.

Although we have argued that the family and the parent-child relationship are the primary and longest-lasting contexts within which the nurturing of children's developing affective psychophysiology occurs, they are by no means the only ones. In particular, as children progress through childhood and into adolescence, time spent outside the home in the neighborhood and school contexts, and experiences and relationships with peers and friends, become increasingly likely to contribute to development. Compared to research on the family context, there have been fewer studies of the socializing influences of neighborhoods, schools and teachers, and peers and friends that have examined children's or adolescents' affective psychophysiology (Masten, Telzer, Fuligni, Lieberman, & Eisenberger, 2012; Murray-Close, 2013). We have begun to look at these contexts in our studies of adolescents' autonomic, adrenocortical, inflammatory, and neural activity. Similar to what we have seen with respect to parenting, some of our studies have shown moderating effects of adolescents' affective psychophysiology. For example, parasympathetic reactivity to an anxiety-induction task moderated the protective benefit of having a supportive close friend on adolescent girls' suicidal ideation (Giletta et al., 2017). More supportiveness predicted less suicidal ideation for girls who showed little RSA change or RSA increases from baseline, suggesting the task was experienced as either safe or not strongly personally relevant. Girls who showed RSA decreases to the social evaluation task, suggesting it was experienced as a challenge or threat, subsequently reported greater suicidality regardless of having a supportive friend. As another example, in a study of Mexican-origin adolescents in predominantly lower-income families (Weissman, Gelardi et al., 2018), neural activity in several regions involved in emotion arousal and mentalizing—thinking about the mental states of oneself or others—moderated the risk that exposure to neighborhood and school criminal activities posed for youths' externalizing problems. Greater activity of the left temporal parietal junction (TPJ), posterior cingulate cortex (PCC), and left amygdala while youth thought about their own sad feelings in response to viewing emotion faces buffered the predictive association between greater crime exposure and elevated externalizing problems. This suggests that neural activity indicative of experiencing greater sad arousal (left amygdala) and greater recognition (left TPJ, PCC) of that arousal—potentially corresponding to affective and cognitive empathy, respectively—protected youths from being willing to take part in the dangerous and violent activities that they saw in their surrounding social contexts.

In other studies, we have seen direct links between peer and school experiences and adolescents' affective psychophysiology. For examples, adolescent girls who were more often the target of relational victimization by peers manifested blunted HPA reactivity (Calhoun et al., 2014) but heightened proinflammatory cytokine reactivity (Giletta et al., 2018) to the anxiety-inducing social evaluation task referred to previously, perhaps revealing mechanisms by which peer victimization undermines emotional and physical health. Similarly, in the sample of Mexican-origin adolescents, witnessing more discrimination and violence by peers at school in the preceding 3 years predicted heightened activation of the right subgenual anterior cingulate cortex (subACC) in response to being excluded from play during the Cyberball task, an online game of catch between the youth and two avatars (Schriber et al., 2018). The subACC has been implicated in experiences of "social pain" (Novembre, Zanon, & Silani, 2015) and social-cognitive processing of emotional information (Bush, Luu, & Posner, 2000), suggesting that even being a bystander to peer hostility may sensitize one to being the target of peer victimization. Moreover, heightened right subACC activity partially mediated the predictive link between hostile school contexts and youths' own subsequent affiliation with deviant peers and oppositional and conduct problems (Schriber et al., 2018). Yet, returning to the theme

of the primacy and enduring importance of the family context, this connection between affective psychophysiology and behavioral adjustment was buffered in youths who reported strong family connectedness. Although experiencing more hostile school contexts still predicted greater right subAcc reactivity to social exclusion, feeling close to and connected with their families appeared to protect youths from being motivated to act on their social pain by acting out against others. Thus, the quality of one social context—the family—moderated the behavioral effects of affective psychophysiology that were shaped by experiences of another social context—peers at school.

Conclusions and Future Directions

As we argued at the beginning of this chapter, it is theoretically and empirically challenging to grapple with the questions arising from an interest in understanding the psychophysiology of emotional development. From the foundational research conducted in the latter years of the twentieth century, the past two decades have borne witness to numerous advances that have positioned the field to address these challenges. New developmental and affective theories are providing frameworks for reconsidering the questions that can and should be posed in order to garner new insights and deeper understanding. A common element across many of these theories is the recognition that emotions must be understood as contextually embedded dynamic processes, sensitive both to the nuances of immediate situations and to the specific life experiences of individuals. The collective elements of emotions, including their complex underlying neurobiology, operate as adaptive processes that support personal and interpersonal functioning within salient contexts, and emotions both shape and are shaped in these social niches. Among the meaningful questions to ask, then, are those pertaining to how the developing nature of children's affective psychophysiology plays out in their interactions and relationships with others.

Asking questions that have potential to bring new insights is one challenge; seeking to answer such questions is another. When we have an approach to scientific investigations that has worked for us in past, especially one that requires specialized training or equipment, we often continue to apply that procedure in future investigations. Or, as variously attributed to Kaplan (1964), Maslow (1966), and others, "If all you have is a hammer, everything looks like a nail." Although there is merit in recognizing the potential for obtaining further benefits from established protocols, letting the structure and requirements of a procedure drive the question that is posed carries the risk of limiting what we can learn. As with all sciences, developmental affective psychophysiology will be best served when research methods and analyses are developed or selected to fit the research question, rather than the converse. When the question is complex—for example, when it involves the developing temporality of the multiple interrelated systems, functions, or processes that comprise emotions—so too must the methods be multifaceted to access these elements of emotion and the analyses appropriately sophisticated to reveal their relations and chronometry. Fortunately, continuing refinements and novel additions to the technologies for measuring psychophysiological activity in multiple systems, and innovations to paradigms that increase ecological validity without sacrificing rigor, are providing the kinds of data that developmental scientists need to address these questions. Similarly, advances in quantitative theory and methodology, and increased collaboration between developmental and quantitative scientists, are now providing the tools needed for analyzing neurobiological and other components of emotions across multiple levels and over multiple time scales.

In this chapter, we have reviewed some of the ways in which we and others have made use of, and hopefully also have contributed to, the recent developments in theories, methods, and analyses that have made the study of developmental affective psychophysiology such an exciting and

growing field of research. Without question, today we know more about the psychophysiology of emotional development than we have known at any time in the past. Seen through a more critical eye, though, one could argue that this field is still relying on time-tested but time-worn techniques to produce information that, however novel it may be, is also piecemeal and disconnected. Leveling this charge against our own work specifically, for every recent study in which we have attempted to make progress on one aspect of research, we have perpetuated another long-standing practice that has limited this progress. For example, we have used simple difference scores to quantify psychophysiological activity in emotional contexts (e.g., Hastings, Kahle, et al., 2018), even though we have been among the advocates for applying dynamic quantitative methods to continuously recorded data. We have used static pictures of emotional faces as stimuli (e.g., Weissman, Guyer, et al., 2018), even though we recognize these are not ecologically valid representations of how children encounter the emotions of others. We have used structured laboratory tasks to look at physiology and emotion at one specific age (e.g., Kahle et al., 2018), even though we have argued that individuals' life histories are important for understanding their affective psychophysiology at any given age. And we have examined a single indicator of the activity of a single physiological system (Hastings, Grady, & Barrieau, 2018), even though we are fully aware that every affective experience or emotional capacity is the product of multiple physiological systems.

Looking forward, then, we think that one of the most important goals to be pursued in the next generation of research is the bringing of a truly integrated and holistic approach to the study of the psychophysiology of emotional development. To repeat the long-winded question, we posed near the beginning of this chapter, "How are the dynamic activities of several physiological systems related to the experience, expression and understanding of one or more emotions, and to the regulation of those emotions within the context of the stimulus that is eliciting those emotions, for an individual of a given age with a given history of relationships and experiences?" To be sure, developmental affective psychophysiology is neither the first nor the only field within the developmental sciences to be faced with the ontological challenge of progressing from studying pieces of behavior to studying the whole child (Oakes, 2009). Although unquestionably difficult and daunting, the field is beginning to move in this direction, largely through the creative research of emerging developmental scientists who are applying cutting-edge technologies, procedures and analyses, informed from multiple disciplines and perspectives. From such ambitious and auspicious efforts, a "grand unifying theory" of the development of emotional psychophysiology—and perhaps, of emotional development more broadly—may be on the horizon.

References

Adam, E. K. (2012). Emotion-cortisol transactions occur over multiple time scales in development: Implications for research on emotion and the development of emotional disorders. *Monographs of the Society for Research in Child Development, 77*(2), 17–27.

Alkon, A., Goldstein, L. H., Smider, N., Essex, M., Kupfer, D. J., et al. (2003). Developmental and contextual influences on autonomic reactivity in young children. *Developmental Psychobiology, 42*, 64–78.

Alkon, A., Boyce, W. T., Davis, N. V., & Eskenazi, B. (2011). Developmental changes in autonomic nervous system resting and reactivity measures in Latino children from 6 to 60 months of age. *Journal of Developmental and Behavioral Pediatrics, 32*(9), 668–677.

Allen, M., & Matthews, K. A. (1997). Hemodynamic responses to laboratory stressors in children and adolescents: The influences of age, race, and gender. *Psychophysiology, 34*(3), 329–339.

Allison, A. L., Peres, J. C., Boettger, C., Leonbacher, U., Hastings, P. D., & Shirtcliff, E. A. (2012). Fight, flight, or fall: Autonomic nervous system reactivity during skydiving. *Personality and Individual Differences, 53*, 218–223.

Beauchaine, T. P. (2001). Vagal tone, development, and Gray's motivational theory: Toward an integrated model of autonomic nervous system functioning in psychopathology. *Development and Psychopathology, 13*(2), 183–214.

Beauchaine, T. P. (2012). Physiological markers of emotional and behavioral dysregulation in externalizing psychopathology. *Monographs of the Society for Research in Child Development, 77*(2), 79–86.

Beauchaine, T. P. (2015). Respiratory sinus arrhythmia: A transdiagnostic biomarker of emotion dysregulation and psychopathology. *Current Opinion in Psychology, 3*, 43–47.

Beauchaine, T. P., Gatzke-Kopp, L., Neuhaus, E., Chipman, J., Reid, M. J., & Webster-Stratton, C. (2013). Sympathetic- and parasympathetic-linked cardiac function and prediction of externalizing behavior, emotion regulation, and prosocial behavior among preschoolers treated for ADHD. *Journal of Consulting and Clinical Psychology, 81*(3), 481–493. https://doi.org/10.1037/a0032302

Beckes, L., & Coan, J. A. (2011). Social baseline theory: The role of social proximity in emotion and economy of action. *Social and Personality Psychology Compass, 5*, 976–988.

Bell, R. Q. (1968). A reinterpretation of the direction of effects in studies of socialization. *Psychological Review, 75*, 81–95. https://doi.org/10.1037/h0025583

Bell, Z., Shader, T., Webster-Stratton, C., Reid, M. J., & Beauchaine, T. P. (2018). Improvements in negative parenting mediate changes in children's autonomic responding following a preschool intervention for ADHD. *Clinical Psychological Science, 6*, 134–144.

Belsky, J. (1984). The determinants of parenting: A process model. *Child Development, 55*, 83–96.

Belsky, J., Bakermans-Kranenburg, M. J., & Van Ijzendoorn, M. H. (2007). For better and for worse: Differential susceptibility to environmental influences. *Current Directions in Psychological Science, 16*(6), 300–304. https://doi.org/10.1111/j.1467-8721.2007.00525.x

Berntson, G. G., Bigger, J. T., Eckberg, D. L., Grossman, P., Kaufmann, P. G., Malik, M., … W, M. (1997). Heart rate variability: Origins, methods, and interpretive caveats. *Psychophysiology, 34*(6), 623–648.

Berntson, G., & Cacioppo, J. (2007). Integrative physiology: Homeostasis, allostasis, and the orchestration of systemic physiology. In J. T. Cacioppo, L. G. Tassinary, & G. G. Berntson (Eds.), *Handbook of psychophysiology* (3rd ed., pp. 453–481). New York, NY: Cambridge University Press.

Berntson, G. G., Cacioppo, J. T., Quigley, K. S., & Fabro, V. T. (1994). Autonomic space and psychophysiological response. *Psychophysiology, 31*(1), 44–61.

Berntson, G. G., Quigley, K. S., & Lozano, D. (2007). Cardiovascular psychophysiology. In J. T. Cacioppo, L. G. Tassinary, & G. Berntson (Eds.), *Handbook of psychophysiology* (2nd ed., pp. 182–210). New York, NY: Cambridge University Press.

Blandon, A. Y., Calkins, S. D., Keane, S. P., & O'Brien, M. (2008). Individual differences in trajectories of emotion regulation processes: The effects of maternal depressive symptomatology and children's physiological regulation. *Developmental Psychology, 44*(4), 1110–1123.

Bradley, M. M., & Lang, P. J. (2007). Emotion and motivation. In J. T. Cacioppo, L. G. Tassinary, & G. G. Berntson (Eds.), *Handbook of psychophysiology* (pp. 581–607). New York, NY: Cambridge University Press.

Breaux, R. P., McQuade, J. D., Harvey, E. A., & Zakarian, R. J. (2018). Longitudinal associations of parental emotion socialization and children's emotion regulation: The moderating role of ADHD symptomatology. *Journal of Abnormal Child Psychology, 46*, 671–683.

Bronfenbrenner, U., & Ceci, S. J. (1994). Nature-nuture reconceptualized in developmental perspective: A bioecological model. *Psychological Review, 101*(4), 568–586.

Brooker, R. J., & Buss, K. A. (2010). Dynamic measures of RSA predict distress and regulation in toddlers. *Developmental Psychobiology, 52*(4), 372–382. https://doi.org/10.1002/dev.20432

Brownley, K. A., Hurwitz, B. E., & Schneiderman, N. (2000). Cardiovascular psychophysiology. In J. T. Cacioppo, L. G. Tassinary, & G. G. Berntson (Eds.), Handbook of psychophysiology, 2nd Ed. (pp. 224–264). NY: Cambridge University Press.

Burt, K. B., & Obradović, J. (2013). The construct of psychophysiological reactivity: Statistical and psychometric issues. *Developmental Review, 33*(1), 29–57. https://doi.org/10.1016/j.dr.2012.10.002

Bush, G., Luu, P., & Posner, M. I. (2000). Cognitive and emotional influences in anterior cingulate cortex. *Trends in Cognitive Sciences, 4*, 215–222. https://doi.org/10.1016/S1364-6613(00)01483-2

Buss, K. A., & Kiel, E. J. (2004). Comparison of sadness, anger, and fear facial expressions when toddlers look at their mothers. *Child Development, 75*, 1761–1773.

Butler, E. A., Gross, J. J., & Barnard, K. (2014). Testing the effects of suppression and reappraisal on emotional concordance using a multivariate multilevel model. *Biological Psychology, 98*(1), 6–18. https://doi.org/10.1016/j.biopsycho.2013.09.003

Calhoun, C. D., Helms, S. W., Heilbron, N., Rudolph, K. D., Hastings, P. D., & Prinstein, M. J. (2014). Relational victimization, friendship, and adolescents' hypothalamic-pituitary-adrenal axis responses to an in vivo social stressor. *Development and Psychopathology, 26*, 605–618. https://doi.org/10.1017/S0954579414000261

Calkins, S. D. (1997). Cardiac vagal tone indices of temperamental reactivity and behavioral regulation in young children. *Developmental Psychobiology, 31*(2), 125–135.

Calkins, S. D., Graziano, P. A., Berdan, L. E., Keane, S. P., & Degnan, K. A. (2008). Predicting cardiac vagal regulation in early childhood from maternal-child relationship quality during toddlerhood. *Developmental Psychobiology, 50*(8), 751–766. https://doi.org/10.1002/dev.20344

Calkins, S. D., & Keane, S. P. (2004). Cardiac vagal regulation across the preschool period: Stability, continuity, and implications for childhood adjustment. *Developmental Psychobiology, 45*(3), 101–112. https://doi.org/10.1002/dev.20020

Cicchetti, D. (2006). Development and psychopathology. In D. Cicchetti & D. Cohen (Eds.), *Developmental psychopathology: Theory and method* (Vol. 1, 2nd ed., pp. 1–23). Hoboken, NJ: Wiley & Sons.

Cole, P. M., Dennis, T. A., Smith-Simon, K. E., & Cohen, L. H. (2009). Preschoolers' emotion regulation strategy understanding: Relations with emotion socialization and child self-regulation. *Social Development, 18*(2), 324–352. https://doi.org/10.1111/j.1467-9507.2008.00503.x

Cole, P. M., Jordan, P. R., & Zahn-Waxler, C. (1990). *Mood induction stimulus for children*. Bethesda, MD: National Institute of Mental Health.

Cole, P. M., Martin, S. E., & Dennis, T. A. (2004). Emotion regulation as a scientific construct: Methodological challenges and directions for child development research. *Child Development, 75*(2), 317–333. https://doi.org/10.1111/j.1467-8624.2004.00673.x

Cox, M., Mills-Koonce, R., Propper, C., & Gariépy, J. (2010). Systems theory and cascades in developmental psychopathology. *Development and Psychopathology, 22*(3), 497–506. https://doi.org/10.1017/S0954579410000234

Critchley, H. D. (2005). Neural mechanisms of autonomic, affective, and cognitive integration. *The Journal of Comparative Neurology, 493*(1), 154–166. https://doi.org/10.1002/cne.20749

Cui, L., Morris, A. S., Harrist, A. W., Larzelere, R. E., Criss, M. M., & Houltberg, B. J. (2015). Adolescent RSA responses during an anger discussion task: Relations to emotion regulation and adjustment. *Emotion, 15*(3), 360–372. https://doi.org/10.1037/emo0000040

Dahl, R. E., & Gunnar, M. R. (2009). Heightened stress responsiveness and emotional reactivity during pubertal maturation: Implications for psychopathology. *Development and Psychopathology, 21*, 1–6.

Damasio, A. (2000). A second chance for emotion. In R. D. Lane & L. Nadel (Eds.), Cognitive neuroscience of emotion (pp. 12–23). NY: Oxford University Press.

Dan-Glauser, E. S., & Gross, J. J. (2011). The temporal dynamics of two response-focused forms of emotion regulation: Experiential, expressive, and autonomic consequences. *Psychophysiology, 48*(9), 1309–1322. https://doi.org/10.1111/j.1469-8986.2011.01191.x

Darwin, C. (1872/1999). *The expression of the emotions in man and animals*. London, UK: John Murray.

Davis, E. L., Quiñones-Camacho, L. E., & Buss, K. A. (2016). The effects of distraction and reappraisal on children's parasympathetic regulation of sadness and fear. *Journal of Experimental Child Psychology, 142*, 344–358. https://doi.org/10.1016/j.jecp.2015.09.020

Dawson, M., Schell, A., & Filion, D. (2000). The electrodermal system. In J. T. Cacioppo, L. G. Tassinary, & G. G. Berntson (Eds.), *Handbook of psychophysiology* (2nd ed., pp. 200–223). NY: Cambridge University Press. New York.

Denham, S. A. (1998). *Emotional development in young children*. New York, NY: Guilford Press.

Dennis, T. A., Buss, K. A., & Hastings, P. D. (2012). Physiological measures of emotion from a developmental perspective: State of the science. *Monographs of the Society for Research in Child Development, 77*(2), 6.

Dennis, T. A., Cole, P. M., Wiggins, C. N., Cohen, L. H., & Zalewski, M. (2009). The functional organization of preschool-age children's emotion expressions and actions in challenging situations. *Emotion, 9*(4), 520–530. https://doi.org/10.1037/a0016514

de Veld, D. M. J., Riksen-Walraven, J. M., & de Weerth, C. (2012). The relation between emotion regulation strategies and physiological stress responses in middle childhood. *Psychoneuroendocrinology, 37*(8), 1309–1319. https://doi.org/10.1016/j.psyneuen.2012.01.004

de Waal, F. B. M. (2008). Putting the altruism back into altruism: The evolution of empathy. *Annual Review of Psychology, 59*, 279–300. https://doi.org/10.1146/annurev.psych.59.103006.093625

Eisenberg, N., Sadovsky, A., Spinrad, T. L., Fabes, R. A., Losoya, S. H., Valiente, C., … Shepard, S. A. (2005). The relations of problem behavior status to children's negative emotionality, effortful control, and impulsivity: Concurrent relations and prediction of change. *Developmental Psychology, 41*(1), 193–211. https://doi.org/10.1037/0012-1649.41.1.193

Eisenberg, N., Valiente, C., Morris, A. S., Fabes, R. A., Cumberland, A., Reiser, M., … Losoya, S. (2003). Longitudinal relations among parental emotional expressivity, children's regulation, and quality of socioemotional functioning. *Developmental Psychology, 39*(1), 3–19. https://doi.org/10.1037/0012-1649.39.1.3

Ellis, B. J., Boyce, W. T., Belsky, J., Bakermans-Kranenburg, M. J., & van Ijzendoorn, M. H. (2011). Differential susceptibility to the environment: An evolutionary--neurodevelopmental theory. *Development and Psychopathology, 23*(1), 7–28. https://doi.org/10.1017/S0954579410000611

El-Sheikh, M. (2005). Stability of respiratory sinus arrhythmia in children and young adolescents: A longitudinal examination. *Developmental Psychobiology, 46*(1), 66–74. https://doi.org/10.1002/dev.20036

El-Sheikh, M., Keiley, M., & Hinnant, J. B. (2010). Developmental trajectories of skin conductance level in middle childhood: Sex, race, and externalizing behavior problems as predictors of growth. *Biological Psychology, 83*(2), 116–124. https://doi.org/10.1016/j.biopsycho.2009.11.009

El-Sheikh, M., & Whitson, S. A. (2006). Longitudinal relations between martial conflict and child adjustment: Vagal regulation as a protective factor. *Journal of Family Psychology, 20*, 30–39.

Feldman, R. (2012). Parent-infant synchrony: A biobehavioral model of mutual influences in the formation of affiliative bonds. *Monographs of the Society for Research in Child Development, 77*, 42–51.

Fowles, D. C. (1988). Psychophysiology and psychopathology: A motivational approach. *Psychophysiology, 25*, 373–391.

Fox, N. A., Kirwan, M., & Reeb-Sutherland, B. (2012). Measuring the physiology of emotion and emotion regulation—timing is everything. *Monographs of the Society for Research in Child Development, 77*, 98–108. https://doi.org/10.1111/j.1540-5834.2011.00668.x

Fridja, N. (1986). *The emotions*. Cambridge, UK: Cambridge University Press.

Gentzler, A. L., Rottenberg, J., Kovacs, M., George, C. J., & Morey, J. N. (2012). Aypical development of resting respiratory sinus arrhythmia in children at high risk for depression. *Developmental Psychobiology, 54*, 556–567.

Giletta, M., Calhoun, C. D., Hastings, P. D., Rudolph, K. D., Nock, M. K., & Prinstein, M. J. (2015). Multi-level risk factors for suicidal ideation among at-risk adolescent females: The role of hypothalamic-pituitary-adrenal axis responses to stress. *Journal of Abnormal Child Psychology, 43*, 807–820. https://doi.org/10.1007/s10802-014-9897-2

Giletta, M., Hastings, P. D., Rudolph, K. D., Bauer, D. J., Nock, M. K., & Prinstein, M. J. (2017). Suicide ideation among high-risk adolescent females: Examining the interplay between parasympathetic regulation and friendship support. *Development and Psychopathology, 29*, 1161–1175. https://doi.org/10.1017/S0954579416001218

Giletta, M., Slavich, G. M., Rudolph, K. D., Hastings, P. D., Nock, M. K., & Prinstein, M. J. (2018). Peer victimization predicts heightened inflammatory reactivity to social stress in cognitively vulnerable adolescents. *Journal of Child Psychology and Psychiatry, 59*, 129–139. https://doi.org/10.1111/jcpp.12804

Giuliano, R. J., Skowron, E. A., & Berkman, E. T. (2015). Growth models of dyadic synchrony and mother–child vagal tone in the context of parenting at-risk. *Biological Psychology, 105*, 29–36.

Goldsmith, H. H., & Rothbart, M. (1996). *The laboratory temperament assessment battery manual*. Madison, WI: Personality Development Laboratory, University of Wisconsin.

Granger, D. A., Kivlighan, K. T., Blair, C., El-Sheikh, M., Mize, J., Lisonbee, J. A., & Buckhalt, J. A. (2006). Integrating the measurement of salivary-amylase into studies of child health, development, and social relationships. *Journal of Social and Personal Relationships, 23*(2), 267–290. https://doi.org/10.1177/0265407506062479

Graziano, P. A., Bagner, D. M., Sheinkopf, S. J., Vohr, B. R., & Lester, B. M. (2012). Evidence-based intervention for young children born premature: Preliminary evidence for associated changes in physiological regulation. *Infant Behavior and Development, 35*, 417–428.

Grimm, K. J., Ram, N., & Hamagami, F. (2011). Nonlinear growth curves in developmental research. *Child Development, 82*, 1357–1371. https://doi.org/10.1111/j.1467-8624.2011.01630.x

Gross, J. J. (1998). Antecedent- and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology, 74*(1), 224–237. https://doi.org/10.1037/0022-3514.74.1.224

Gross, J. J., & Levenson, R. W. (1995). Emotion elicitation using films. *Cognition and Emotion, 9*, 87–108.

Gross, J. J., & Thompson, R. (2007). Emotional regulation conceptual foundations. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3–24). New York, NY: The Guilford Press.

Gunnar, M. R., & Adam, E. K. (2012). The hypothalamic–pituitary–adrenocortical system and emotion: Current wisdom and future directions. *Monographs of the Society for Research in Child Development, 77*(2), 109–119.

Gunnar, M. R., & Quevedo, K. (2007). The neurobiology of stress and development. *Annual Review of Psychology, 58*, 145–173. https://doi.org/10.1146/annurev.psych.58.110405.085605

Gunnar, M. R., Talge, N. M., & Herrera, A. (2009). Stressor paradigms in developmental studies: What does and does not work to produce mean increases in salivary cortisol. *Psychoneuroendocrinology, 34*, 953–967.

Hankin, B. L., & Abela, J. R. Z. (2005). *Development of psychopathology: A vulnerability-stress perspective*. Thousand Oaks, CA: Sage.

Hastings, P. D., Buss, K. A., & Dennis, T. A. (2012). Introduction to section one: Integrative approaches to the study of physiology and emotion. *Monographs of the Society for Research in Child Development, 77*, 6–7. https://doi.org/10.1111/j.1540-5834.2011.00655.x

Hastings, P. D., & De, I. (2008). Parasympathetic regulation and parental socialization of emotion: Biopsychosocial processes of adjustment in preschoolers. *Social Development, 17*(2), 211–238. https://doi.org/10.1111/j.1467-9507.2007.00422.x

Hastings, P. D., Grady, J. G., & Barrieau, L. E. (2018). Children's anxious characteristics predict how their parents socialize emotions. *Journal of Abnormal Child Psychology*. https://doi.org/10.1007/s10802-018-0481-z

Hastings, P. D., & Guyer, A. E. (2014). The physiological underpinnings of child psychopathology. In B. H. Schneider (Ed.), *Child psychopathology* (pp. 88–118). NY: Cambridge University Press. New York

Hastings, P. D., Kahle, S., Fleming, C., Lohr, M. J., Katz, L. F., & Oxford, M. L. (2018). An intervention that increases parental sensitivity in families referred to Child Protective Services also changes toddlers' parasympathetic regulation. *Developmental Science., 22*, e12725.

Hastings, P. D., Kahle, S. S., & Han, G. H. (2014). Developmental affective psychophysiology: Using physiology to inform our understanding of emotional development. In K. H. Lagattuta (Ed.), *Children and Emotion. New Insights into Developmental Affective Sciences* (pp. 13–28). Basel, Switzerland: Karger.

Hastings, P. D., Kahle, S., & Nuselovici, J. M. (2014). How well socially wary preschoolers fare over time depends on their parasympathetic regulation and socialization. *Child Development, 85*(4), 1586–1600. https://doi.org/10.1111/cdev.12228

Hastings, P. D., Klimes-Dougan, B., Kendziora, K. T., Brand, A., & Zahn-Waxler, C. (2014). Regulating sadness

and fear from outside and within: Mothers' emotion socialization and adolescents' parasympathetic regulation predict the development of internalizing difficulties. *Development and Psychopathology, 26*, 1369–1384. https://doi.org/10.1017/S0954579414001084

Hastings, P. D., Miller, J. G., Kahle, S., & Zahn-Waxler, C. (2014). The neurobiological bases of empathic concern for others. In M. Killen & J. Smetana (Eds.), *Handbook of moral development* (2nd ed., pp. 411–434). New York, NY: Psychology Press.

Hastings, P. D., Nuselovici, J. N., Klimes-Dougan, B., Kendziora, K. T., Usher, B. A., Ho, M. R., & Zahn-Waxler, C. (2009). Dysregulated coherence of subjective and cardiac emotional activation in adolescents with internalizing and externalizing problems. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 50*(11), 1348–1356. https://doi.org/10.1111/j.1469-7610.2009.02159.x

Hastings, P. D., Nuselovici, J. N., Utendale, W. T., Coutya, J., McShane, K. E., & Sullivan, C. (2008). Applying the polyvagal theory to children's emotion regulation: Social context, socialization, and adjustment. *Biological Psychology, 79*, 299–306.

Hastings, P. D., Sullivan, C., McShane, K. E., Coplan, R. J., Utendale, W. T., & Vyncke, J. D. (2008). Parental socialization, vagal regulation, and preschoolers' anxious difficulties: Direct mothers and moderated fathers. *Child Development, 79*(1), 45–64. https://doi.org/10.1111/j.1467-8624.2007.01110.x

Hastings, P. D., Zahn-Waxler, C., & McShane, K. (2006). We are, by nature, moral creatures: Biological bases of concern for others. In M. Killen & J. G. Smetana (Eds.), *Handbook of moral development* (pp. 483–516). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Hastings, P. D., Zahn-Waxler, C., Robinson, J., Usher, B., & Bridges, D. (2000). The development of concern for others in children with behavior problems. *Developmental Psychology, 36*(5), 531–546. https://doi.org/10.1037/0012-1649.36.5.531

Helm, J. L., Sbarra, D., & Ferrer, E. (2012). Assessing cross-partner associations in physiological responses via coupled oscillator models. *Emotion, 12*(4), 748–762.

Helm, J. L., Miller, J. G., Kahle, S., Troxel, N. R., & Hastings, P. D. (2018). On measuring and modeling physiological synchrony in dyads. *Multivariate Behavioral Research*. https://doi.org/10.1080/00273171.2018.1459292

Hinnant, J. B., Elmore-Staton, L., & El-Sheikh, M. (2011). Developmental trajectories of respiratory sinus arrhythmia and preejection period in middle childhood. *Developmental Psychobiology, 53*(1), 59–68. https://doi.org/10.1002/dev.20487

Hubbard, J. A., Smithmyer, C. M., Ramsden, S. R., Parker, E. H., Flanagan, K. D., Dearing, K. F., … Simons, R. F. (2002). Observational, physiological, and self-report measures of children's anger: Relations to reactive versus proactive aggression. *Child Development, 73*(4), 1101–1118. https://doi.org/10.1111/1467-8624.00460

Jollant, F., Lawrence, N. L., Olié, E., Guillaume, S., & Courtet, P. (2011). The suicidal mind and brain: A review of neuropsychological and neuroimaging studies. *World Journal of Biological Psychiatry, 12*, 319–339.

Kahle, S. (2017). *Linking autonomic reactivity and recovery with emotion and emotion regulation across development* (Doctoral dissertation). Retrieved from ProQuest. (ISBN: 9780355150759).

Kahle, S., & Hastings, P. D. (2015). The neurobiology and physiology of emotions: A developmental perspective. In R. Scott & S. Kosslyn (Eds.), *Emerging trends in the social and behavioral sciences* (pp. 1–15). Hoboken, NJ: Wiley.

Kahle, S., Miller, J. G., Helm, J. L., & Hastings, P. D. (2018). Linking autonomic physiology and emotion regulation in preschoolers: The role of reactivity and recovery. *Developmental Psychobiology, 60*, 775–588.

Kahle, S., Miller, J. G., Lopez, M., & Hastings, P. D. (2016). Sympathetic recovery from anger is associated with emotion regulation. *Journal of Experimental Child Psychology, 142*, 359–371.

Kahle, S., Miller, J. G., Troxel, N. R., & Hastings, P. D. (unpublished). No pain, no gain? The short- and long-term physiological benefits and costs when children regulate frustration by diverting attention.

Kaltas, G., & Chrousos, G. (2007). The neuroendocrinology of stress. In J. T. Cacioppo, L. Tassinary, & G. G. Berntson (Eds.), *Handbook of psychophysiology* (pp. 303–318). Cambridge: Univ Press.

Kaplan, A. (1964). *The conduct of inquiry: Methodology for behavioral science*. San Francisco, CA: Chandler Publishing Company.

Katz, L. F., & Rigterink, T. (2012). Domestic violence and emotion socialization. *Monographs of the Society for Research in Child Development, 77*(2), 52–60.

Keenan, K., & Shaw, D. (1997). Developmental and social influences on young girls' early problem behavior. *Psychological Bulletin, 121*, 95–113.

Keller, H. (1903/2010). *The story of my life*. New York, NY: Penguin Random House.

Kennedy, A. E., Rubin, K. H., Hastings, P. D., & Maisel, B. (2004). Longitudinal relations between child vagal tone and parenting behavior: 2 to 4 years. *Developmental Psychobiology, 45*(1), 10–21. https://doi.org/10.1002/dev.20013

Klimes-Dougan, B., Hastings, P. D., Granger, D. A., Usher, B. A., & Zahn-Waxler, C. (2001). Adrenocorticol activity in at-risk and normally developing adolescents: Individual difference in salivary cortisol response to social challenge, basal levels, and diurnal variations. *Development and Psychopathology, 13*, 695–719.

Kogan, A., Oveis, C., Carr, E. W., Gruber, J., Mauss, I. B., Shallcross, A., … Keltner, D. (2014). Vagal activity is quadratically related to prosocial traits, prosocial emotions, and observer perceptions of prosociality. *Journal of Personality and Social Psychology, 107*, 1051–1063. https://doi.org/10.1037/a0037509

Kreibig, S. D. (2010). Autonomic nervous system activity in emotion: A review. *Biological Psychology,*

84(3), 394–421. https://doi.org/10.1016/j.biopsycho.2010.03.010

Lemerise, E. A., & Dodge, K. A. (2008). The development of anger and hostile interactions. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (pp. 730–741). New York, NY: Guilford Press.

Lemerise, E. A., & Harper, B. D. (2010). The development of anger from preschool to middle childhood: Expressing, understanding, and regulating anger. In M. Potegal, G. Stemmler, & C. Spielberger (Eds.), *International handbook of Anger: Constituent and concomitant biological, psychological, and social processes* (pp. 219–229). New York, NY: Springer.

Lengua, L. J., & Sandler, I. N. (1996). Self-regulation as a moderator of the relation between coping and symptomatology in children of divorce. *Journal of Abnormal Child Psychology, 24*, 681–701.

Lerner, R. M. (2002). Developmental systems theory: The sample case of developmental contextualism. In *Concepts and theories of human development* (3rd ed., pp. 195–217). Mahwah, NJ: Lawrence Erlbaum Associates.

Levenson, R. W. (1994). Human emotion: A functional view. In P. Ekman & R. J. Davidson (Eds.), *The nature of emotion: Fundamental questions* (pp. 123–126). New York, NY: Oxford University Press.

Lewis, M., Ramsay, D. S., & Sullivan, M. W. (2006). The relation of ANS and HPA activation to infant anger and sadness response to goal blockage. *Developmental Psychobiology, 48*(5), 397–405. https://doi.org/10.1002/dev.20151

Lewis, M., Sullivan, M. W., & Kim, H. M.-S. (2015). Infant approach and withdrawal in response to a goal blockage: Its antecedent causes and its effect on toddler persistence. *Developmental Psychology, 51*(11), 1553–1563. https://doi.org/10.1037/dev0000043

Lindquist, K. A., Wager, T. D., Kober, H., Bliss-Moreau, E., & Barrett, L. F. (2012). The brain basis of emotion: A meta-analytic review. *The Behavioral and Brain Sciences, 35*, 121–143.

Lunkenheimer, E., Busuito, A., Brown, K. M., & Skowron, E. A. (2018). Mother–child coregulation of parasympathetic processes differ by child maltreatment severity and subtype. *Child Maltreatment, 23*, 211–220.

Marcovitch, S., Leigh, J., Calkins, S. D., Leerks, E. M., O'Brien, M., & Blankson, A. N. (2010). Moderate vagal withdrawal in 3.5-year-old children is associated with optimal performance on executive function tasks. *Developmental Psychobiology, 52*(6), 603–608. https://doi.org/10.1002/dev.20462

Maslow, A. H. (1966). *The psychology of science: A reconnaissance*. New York, NY: Harper & Row.

Masten, C. L., Telzer, E. H., Fuligni, A. J., Lieberman, M. D., & Eisenberger, N. I. (2012). Time spent with friends in adolescence relates to less neural sensitivity to later peer rejection. *Social, Cognitive and Affective Neuroscience, 7*, 106–114.

Matthews, K. A., Salomon, K., Kenyon, K., & Allen, M. T. (2002). Stability of children's and adolescents' hemodynamic responses to psychological challenge: A three-year longitudinal study of a multiethnic cohort of boys and girls. *Psychophysiology, 39*(6), 826–834. https://doi.org/10.1111/1469-8986.3960826

McArdle, J. J., & Epstein, D. B. (1987). Latent growth curves within developmental structural equation models. Child Development, 58(1), 110–133.

McEwen, B. S., & Stellar, E. (1993). Stress and the individual: Mechanisms leading to disease. *Archives of Internal Medicine, 153*(18), 2093–2101. https://doi.org/10.1001/archinte.1993.00410180039004

Meany, M. J. (2001). Maternal care, gene expression, and the transmission of individual differences in stress reactivity across generations. *Annual Review of Neuroscience, 24*, 1161–1192.

Miller, J. G. (2018). *Neurobiological bases of empathy and prosocial behavior* (Doctoral dissertation). Retrieved from ProQuest (ISBN AAI10638463).

Miller, J. G., Chocol, C., Nuselovici, J. N., Utendale, W. T., Simard, M., & Hastings, P. D. (2013). Children's dynamic RSA change during anger and its relations with parenting, temperament, and control of aggression. *Biological Psychology, 92*(2), 417–425. https://doi.org/10.1016/j.biopsycho.2012.12.005

Miller, J. G., & Hastings, P. D. (2016). Biopsychosocial models of prosociality: Compassionate love, vagal regulation, and children's altruism. In *Contexts for young child flourishing: Evolution, family and society* (pp. 185–200).

Miller, J. G., Kahle, S., & Hastings, P. D. (2017). Moderate baseline vagal tone predicts greater prosociality in children. *Developmental Psychology, 53*(2), 274–289.

Miller, J. G., Nuselovici, J. N., & Hastings, P. D. (2016). Nonrandom acts of kindness: Parasympathetic and subjective empathic responses to sadness predict children's prosociality. *Child Development, 87*, 1679–1690. https://doi.org/10.1111/cdev.12629

Miskovic, V., & Schmidt, L. A. (2012). New directions in the study of individual differences in temperament: A brain–body approach to understanding fearful and fearless children. *Monographs of the Society for Research in Child Development, 77*(2), 28–38.

Moss, H. B., Vanyukov, M. M., & Martin, C. S. (1995). Salivary cortisol responses and the risk for substance abuse in prepubertal boys. *Biological Psychiatry, 38*, 547–555.

Murphy, B., Eisenberg, N., Fabes, R., Shepard, R. A., & Guthrie, I. K. (1999). Consistency and change in children's emotionality and regulation: A longitudinal study. *Merrill-Palmer Quarterly, 45*(3), 413–444.

Murray-Close, D. (2013). Psychophysiology of adolescent peer relations I: Theory and research findings. *Journal of Research on Adolescence, 23*, 236–259.

Musser, E. D., Galloway-Long, H. S., Frick, P. J., & Nigg, J. T. (2013). Emotion regulation and heterogeneity in attention-deficit/hyperactivity disorder. *Journal of the American Academy of Child and Adolescent Psychiatry, 52*(2), 163–171. https://doi.org/10.1016/j.jaac.2012.11.009

Nijsen, J. M. A., Croiset, G., Diamant, M., De Wied, D., & Wiegant, V. M. (2001). CRH signaling in the bed nucleus of the stria terminalis is involved in stress-induced cardiac vagal activation in conscious rats. *Neuropsychopharmacology, 24*, 1–10.

Novembre, G., Zanon, M., & Silani, G. (2015). Empathy for social exclusion involves the sensory-discriminative component of pain: A within-subject fMRI study. *Social Cognitive and Affective Neuroscience, 10*, 153–164. https://doi.org/10.1093/scan/nsu038

Oakes, L. M. (2009). The "Humpty Dumpty problem" in the study of early cognitive development: Putting the infant back together again. *Perspectives on Psychological Science, 4*(4), 352–358. https://doi.org/10.1111/j.1745-6924.2009.01137.x

Obradović, J., & Boyce, W. T. (2012). Developmental psychophysiology of emotion processes. *Monographs of the Society for Research in Child Development, 77*, 120–128.

Oxford, M. L., Spieker, S. J., Lohr, M. J., & Fleming, C. B. (2016). Promoting First Relationships ®. *Child Maltreatment, 21*(4), 267–277. https://doi.org/10.1177/1077559516668274

Pérez-Edgar, K., & Hastings, P. (2018). Emotion development from an experimental and individual differences lens. In S. Ghetti (Ed.),. (volume ed.) *The Stevens' Handbook of Experimental Psychology and Cognitive Neuroscience, Vol. 3: Developmental and social psychology* (4th ed.). San Francisco, CA: Wiley. https://doi.org/10.1002/9781119170174.epcn409

Perry, N. B., Calkins, S. D., Nelson, J. A., Leerkes, E. M., & Marcovitch, S. (2012). Mothers' responses to children's negative emotions and child emotion regulation: The moderating role of vagal suppression. *Developmental Psychobiology, 54*(5), 503–513. https://doi.org/10.1002/dev.20608

Perry, N. B., Nelson, J. A., Calkins, S. D., Leerkes, E. M., O'Brien, M., & Marcovitch, S. (2014). Early physiological regulation predicts the trajectory of externalizing behaviors across the preschool period. *Developmental Psychobiology, 56*(7), 1482–1491. https://doi.org/10.1002/dev.21228

Porges, S. W. (1995). Orienting in a defensive world: Mammalian modifications of our evolutionary heritage. A polyvagal theory. *Psychophysiology, 32*(4), 301–318.

Porges, S. W. (2007). The polyvagal perspective. *Biological Psychology, 74*(2), 116–143. https://doi.org/10.1016/j.bbi.2008.05.010

Porges, S. W. (2011). *The polyvagal theory: Neurophysiological foundations of emotions, attachment, communication, and self-regulation*. New York, NY: W. W. Norton & Co.

Porges, S. W., & Furman, S. A. (2011). The early development of the autonomic nervous system provides a neural platform for social behaviour: A polyvagal perspective. *Infant and Child Development, 20*, 106–118. https://doi.org/10.1002/icd.688

Quigley, K. S., & Stifter, C. A. (2006). A comparative validation of sympathetic reactivity in children and adults. *Psychophysiology, 43*(4), 357–365. https://doi.org/10.1111/j.1469-8986.2006.00405.x

Raffaelli, M., Crockett, L. J., & Shen, Y. L. (2005). Developmental stability and change in self-regulation from childhood to adolescence. *The Journal of Genetic Psychology, 166*(1), 54–76.

Rainville, P., Bechara, A., Naqvi, N., & Damasio, A. R. (2006). Basic emotions are associated with distinct patterns of cardiovascular reactivity. *International Journal of Psychophysiology, 61*, 5–18.

Ram, N., & Grimm, K. (2007). Using simple and complex growth models to articulate developmental change: Matching theory to method. *International Journal of Behavioral Development, 31*(4), 303–316. https://doi.org/10.1177/0165025407077751

Rohleder, N., Wolf, J. M., Maldonado, E. F., & Kirschbaum, C. (2006). The psychosocial stress-induced increase in salivary alpha-amylase is independent of saliva flow rate. *Psychophysiology, 43*, 645–652. https://doi.org/10.1111/j.1469-8986.2006.00457.x

Rottenberg, J., Ray, R. D., & Gross, J. J. (2007). Emotion elicitation using films. In *Handbook of emotion elicitation and assessment* (pp. 9–28). New York, NY: Oxford University Press.

Saarni, C. (1999). *The development of emotional competence*. New York, NY: Guilford Press.

Salomon, K. (2005). Respiratory sinus arrhythmia during stress predicts resting respiratory sinus arrhythmia 3 years later in a pediatric sample. *Health Psychology, 24*(1), 68–76. https://doi.org/10.1037/0278-6133.24.1.68

Sameroff, A. (2010). A unified theory of development: A dialectic integration of nature and nurture. *Child Development, 81*(1), 6–22. https://doi.org/10.1111/j.1467-8624.2009.01378.x

Santucci, A. K., Silk, J. S., Shaw, D. S., Gentzler, A., Fox, N. A., & Kovacs, M. (2008). Vagal tone and temperament as predictors of emotion regulation strategies in young children. *Developmental Psychobiology, 50*(3), 205–216. https://doi.org/10.1002/dev.20283

Sapolsky, R. M. (2004). Social status and health in humans and other animals. *Annual Review of Anthropology, 33*, 393–418. https://doi.org/10.1146/annurev.anthro.33.070203.144000

Schriber, R. A., Rogers, C. R., Ferrer, E., Conger, R. D., Robins, R. W., Hastings, P. D., & Guyer, A. E. (2018). Do hostile school environments promote social deviance by shaping neural response to social exclusion? *Journal of Research on Adolescence, 28*, 103–120. https://doi.org/10.1111/jora.12340

Shields, S. A. (1983). Development of autonomic nervous system responsivity in children: A review of the literature. International Journal of Behavioral Development, 6, 291–319.

Smith, M., Hubbard, J. A., & Laurenceau, J.-P. (2011). Profiles of anger control in second-grade children: Examination of self-report, observational, and physiological components. *Journal of Experimental Child Psychology, 110*(2), 213–226. https://doi.org/10.1016/j.jecp.2011.02.006

Smith, R., Thayer, J. F., Khalsa, S. S., & Lane, R. D. (2017). The hierarchical basis of neurovisceral integration. *Neuroscience & Behavioral Reviews, 75*, 274–296.

Spinrad, T. L., Eisenberg, N., Granger, D. A., Eggum, N. D., Sallquist, J., Haugen, R. G., … Hofer, C. (2009). Individual differences in preschoolers' salivary cortisol and alpha-amylase reactivity: Relations to temperament and maladjustment. *Hormones and Behavior, 56*(1), 133–139. https://doi.org/10.1016/j.yhbeh.2009.03.020

Stansbury, K., & Gunnar, M. R. (1994). Adrenocortical activity and emotion regulation. *Monographs of the Society for Research in Child Development, 59*(2–3), 250–283.

Stansbury, K., & Sigman, M. (2000). Responses of preschoolers in two frustrating episodes: emergence of complex strategies for emotion regulation. *The Journal of Genetic Psychology, 161*(2), 182–202. https://doi.org/10.1080/00221320009596705

Stearns, S. C., Allal, N., & Mace, R. (2008). Life history theory and human development. In C. Crawford & D. Krebs (Eds.), *Foundations of evolutionary psychology* (pp. 47–69). New York, NY: Taylor & Francis/Erlbaum.

Stephanie A. Shields, (2016) Development of Autonomic Nervous System Responsitivity in Children: A Review of the Literature. International Journal of Behavioral Development 6(3):291–319

Sturge-Apple, M. L., Davies, P. T., Cicchetti, D., & Manning, L. G. (2012). Interparental violence, maternal emotional unavailability and children's cortisol functioning in family contexts. *Developmental Psychology, 48*(1), 237–249. https://doi.org/10.1037/a0025419

Suveg, C., Shaffer, A., & Davis, M. (2016). Family stress moderates relations between physiological and behavioral synchrony and child self-regulation in mother-preschooler dyads. *Developmental Psychobiology, 58*, 83–97.

Thayer, J. F., Ahs, F., Fredrikson, M., Sollers, J. J., & Wager, T. D. (2012). A meta-analysis of heart rate variability and neuroimaging studies: Implications for heart rate variability as a marker of stress and health. *Neuroscience and Biobehavioral Reviews, 36*(2), 747–756. https://doi.org/10.1016/j.neubiorev.2011.11.009

Thompson, R. A. (2011). Emotion and emotion regulation: Two sides of the developing coin. *Emotion Review, 3*(1), 53–61. https://doi.org/10.1177/1754073910380969

Thompson, R. A., Virmani, E. A., Waters, S. F., Raikes, A., & Meyer, S. (2013). The development of emotion self-regulation: The whole and the sum of the parts. In K. C. Barret, N. A. Fox, G. Morgan, D. Fidler, & L. Daunahuer (Eds.), *The development of self-regulatory processes in development: New directions and international perspectives* (pp. 5–26). New York, NY: Taylor and Francis.

Ugarte, E., Miller, J. G., Weissman, D. G., & Hastings, P. D. (2019). *Vagal flexibility to negative emotions moderates the relations between environmental risk and adjustment problems in childhood*. Baltimore, MD: Society for Research in Child Development.

Valiente, C., Lemery-Chalfant, K., & Swanson, J. (2009). Children's responses to daily social stressors: Relations with parenting, children's effortful control, and adjustment. *Journal of Child Psychology and Psychiatry, 50*, 707–717. https://doi.org/10.1111/j.1469-7610.2008.02019.x

Venables, P. H., & Mitchell, D. A. (1996). The effects of age, sex and time of testing on skin conductance activity. *Biological Psychology, 43*, 87–101.

Vytal, K., & Hamann, S. (2010). Neuroimaging support for discrete neural correlates of basic emotions: A voxel-based meta-analysis. *Journal of Cognitive Neuroscience, 22*, 2864–2885.

Wachs, T. D., & Gandour, M. J. (1983). Temperament, environment, and six month cognitive-intellectual development: A test of the organismic specificity hypothesis. *International Journal of Behavioral Development, 6*, 135–152.

Wagner, N. J., Hastings, P. D., & Rubn, K. H. (2018). Children's autonomic functioning moderates links between maternal rejecting attitudes and preschool aggressive behaviors. *Developmental Psychobiology*. https://doi.org/10.1002/dev.21747

Weissman, D. G., Gelardi, K. L., Conger, R. W., Robins, R. W., Hastings, P. D., & Guyer, A. E. (2018). Adolescent externalizing problems: Contributions of community crime exposure and neural function during emotion introspection in Mexican-origin youth. *Journal of Research on Adolescence, 28*, 551–563. https://doi.org/10.1111/jora.12358

Weissman, D. G., Guyer, A. E., Ferrer, E., Robins, R. W., & Hastings, P. D. (2018). Adolescents' brain-autonomic coupling during emotion processing. *NeuroImage, 183*, 818–827. https://doi.org/10.1016/J.NEUROIMAGE.2018.08.069

Willemen, A. M., Schuengel, C., & Koot, H. M. (2009). Physiological regulation of stress in referred adolescents: The role of the parent-adolescent relationship. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 50*(4), 482–490. https://doi.org/10.1111/j.1469-7610.2008.01982.x

Woody, M. L., Feurer, C., Sosoo, E. E., Hastings, P. D., & Gibb, B. E. (2016). Synchrony of physiological activity during mother-child interaction: Moderation by maternal history of major depressive disorder. *Journal of Child Psychology and Psychiatry, 57*, 843–850. https://doi.org/10.1111/jcpp.12562

Zeman, J., & Shipman, K. (1996). Expression of negative affect: Reasons and methods. *Developmental Psychology, 32*, 842–849.

Zhang, W.-N., Murphy, C. A., & Feldon, J. (2004). Behavioral and cardiovascular responses during latent inhibition of conditioned fear: Measurement by telemetry and conditioned freezing. *Behavioral Brain Research, 154*, 99–209.

Zisner, A. R., & Beauchaine, T. P. (2016). Psychophysiological methods and developmental psychopathology. In D. Chiccetti (Ed.), *Developmental psychopathology, Vol. 2: Developmental neuroscience* (3rd ed., pp. 832–884). Hoboken, NJ: Wiley.

A Neuroscience Perspective on Emotional Development

Santiago Morales and Nathan A. Fox

Abstract

In the current chapter, we suggest that a neuroscientific approach provides a valuable perspective to the study of emotional development. We discuss how a neuroscientific approach offers unique contributions to notable practical and theoretical challenges in the study of the development of emotion and emotion regulation. We exemplify these contributions by reviewing the current knowledge on the development of the expression and regulation of fear and anxiety and their associated neural bases. The literature reviewed highlights the fact that a neuroscientific approach situates the study of emotional development in a larger biological and evolutionary framework facilitating the translation of research across species and providing an account for species-typical development as well as individual variation. A neuroscientific approach also provides methods that permit studying emotional development across several levels of analyses, providing information on the similarity and/or differentiation between processes and mechanisms. We also cover literature that exemplifies how a neuroscientific approach can expand our understanding of how constitutional factors and experiences create the brain networks that support the expression and regulation of emotion across development. Finally, we discuss outstanding issues and future directions with the neuroscientific approach to the study of emotional development.

Introduction

Our ability to experience and express emotions is a core aspect of life. Moreover, regulating when and how we experience, and express, emotions is a crucial component of adaptive functioning. As such, understanding emotional development has important implications for individuals and society as emotional competence is crucial for mental health, physical well-being, and economic wealth (Eisenberg et al., 2001; Knudsen, Heckman, Cameron, & Shonkoff, 2006; Pine & Fox, 2015; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008). However, the scientific study of emotional development faces significant practical and theoretical challenges.

In the current chapter, we argue that a neuroscientific approach provides valuable insight into the study of emotional development, with the following broad contributions (Nelson, Thomas, & DeHaan, 2008): First, a neuroscientific approach places hypotheses and observations in a larger

S. Morales (✉) · N. A. Fox
University of Maryland–College Park, Department of Human Development and Quantitative Methodology, College Park, MD, USA
e-mail: moraless@umd.edu; fox@umd.edu

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_4

biological and evolutionary context, facilitating the translation of human emotional development from – and to – animal models. Second, by examining emotional development with a neuroscientific lens, we leverage several methods that allow us to examine the phenomena of interest at different levels of analysis (e.g., genetic, molecular, structure, function, social), helping differentiate distinct processes and mechanisms. Finally, as we gain a better understanding of the mechanisms and the interactions across several levels of analysis, we gain a picture of emotional development that moves beyond simplistic models (e.g., nature vs. nurture) and allows us to examine how experiences impact the brain circuits that support the expression and regulation of emotion.

In the following sections, we summarize three notable challenges and briefly highlight how a neuroscientific approach provides a unique perspective into these issues. We then briefly review the development of emotion and emotion regulation and its associated neural bases.

Challenge I: Emotion and Emotion Regulation as Distinct Constructs

The first challenge arises when trying to define primary aspects of emotional development such as emotion and emotion regulation. As with most psychological constructs, there is no standard definition of emotion and emotion regulation. However, a particular challenge when defining these constructs is that it is difficult to empirically and theoretically separate emotion from emotion regulation. Although there are considerable debates about the essence of emotions and formal definitions of emotion have been attempted since the beginning of modern psychology (James, 1884) and biology (Darwin, 1872/1998), most authors would agree that emotions are biologically based processes that quickly and automatically evaluate events as well as prepare the organism to act in order to aid well-being and survival (Cole, Martin, & Dennis, 2004; Dennis, Buss, & Hastings, 2012). Recent definitions of emotion reserve emotion terms such as "fear" to the experiential components of the emotions and label as "survival circuits" the behavioral responses and accompanying neurophysiological changes (LeDoux, 2012; LeDoux & Brown, 2017). This distinction between components of emotion is important when studying emotional development, as it is not possible to access the experiential components of emotion during early development. Here, we do not make use of terms such as "survival circuits" and instead use emotion-related terms (e.g., "emotion" and "fear") in line with most of the developmental literature. However, throughout this chapter, we explicitly label the component of emotion being discussed to emphasize this distinction between behavioral and physiological changes compared to conscious feeling states (i.e., fear-related behaviors vs. feelings of fear).

Importantly, this definition of emotion highlights that emotions are by nature regulating the physiology, behavior, and experiences of the organism. In other words, emotions are inherently regulatory; thus, it is difficult to separate them from the processes that regulate them (Campos, Mumme, Kermoian, & Campos, 1994; Cole et al., 2004). Processes that change the valence, intensity, and duration of emotions are often termed emotion regulation (Thompson, 1994).

Most definitions of emotion regulation highlight a wide breadth of such processes including conscious and unconscious processes that change emotional responses such as purposely distracting oneself by focusing on other aspects of the situation or unintentionally looking away from aversive events (Gross & Thompson, 2007). Recent models also distinguish between explicit and implicit strategies as well as automatic and controlled forms of emotion regulation (Braunstein, Gross, & Ochsner, 2017; Etkin, Büchel, & Gross, 2015), further complicating its distinction with emotional responses. For instance, imagine a child being approached by a novel stimulus like a stranger. When the child perceives the stranger approaching, their eyebrows raise, their eyes widen, their heart rate accelerates, and their pupils dilate – clear behavioral and physiological changes associated with fear. The child then turns around, runs away,

clings to their caregiver's leg, and averts their gaze away from the stranger. Although these withdrawal behaviors regulate behavior and lead to decreases in fear-related physiology and behavior, it is less clear if they are part of the expression of fear or if there are implicit and automatic forms of emotion regulation.

Cole et al. (2004) propose that to resolve this challenge it is necessary to measure emotion processes independently from implied emotion regulation processes and/or to assess changes in the emotion due to emotion regulation. However, currently, no single method in developmental psychology is able to empirically make this distinction. As such, developmental psychologists need to make inferences based on several methods. A neuroscientific approach provides a powerful way to measure mental processes as some methods have a high temporal precision, allowing to capture the chronometry of emotional and regulatory processes, while others can indicate which brain regions are involved in emotion and/or emotion regulation. For example, electroencephalography (EEG) measures of brain electrical activity over the scalp that can be decomposed into specific frequency bands or averaged around an event of interest (i.e., event-related potentials; ERP). EEG measures have an excellent temporal resolution. In general, the latency of a measure of interest (e.g., ERP) is thought to indicate whether a mental process is relatively automatic or effortful with shorter latencies indicating shorter information processing and more automatic responses.

Another commonly used measure is magnetic resonance imaging (MRI), which provides several measures of the structure of the brain such as gray matter, white matter, and myelination. Functional MRI (fMRI) provides a measure of brain activity with high spatial resolution. In general, processes that involve the same brain areas are considered to involve similar mental processes, whereas activation in different brain areas is thought to involve different cognitive processes. Moreover, it is possible to describe the interrelations among brain areas by examining structural and/or functional connectivity, providing information about brain networks. Structural connectivity consists of measuring the brain regions that are physically or anatomically connected to each other. On the other hand, functional connectivity refers to measuring brain activity that is temporally related across brain areas, implying that these areas are active at the same time, potentially working together and influencing each other.

As will be reviewed in this chapter, researchers have used these techniques in past decades to measure the time course and networks of brain areas involved in emotional development increasing our understanding of which processes are shared (and different) between emotions and their regulation. Although a neuroscientific approach does not solve this challenge on its own, it can provide important evidence and tools that together with other approaches can serve to better understand the distinction between emotion and emotion regulation.

Challenge II: Emotion and Cognition Integration

The second challenge to studying and understanding emotional development involves treating emotional and cognitive development as categorically different phenomena. The dichotomy between cognition and emotion can be rooted all the way back to dualistic models of the mind and brain/body best exemplified by Descartes and Aristotle, in which emotion and reason were treated as categorically separate constructs. For psychology in general, the dichotomy was exacerbated during the cognitive revolution, which focused on the role of information processing in human cognition. This led the field of cognitive psychology to focus on studying processes such as attention, memory, language, and decision-making, rarely including emotion (Phelps, 2006).

In developmental psychology in particular, this divide was further increased with the undertaking of charting cognitive development, led by work like Piaget's (Maccoby, 1984). For this, researchers studying cognitive development mostly employed experimental methods aimed at characterizing developmental milestones across

development. Examples of such methods can be found in the descriptions of Piaget's experiments and now-classic tasks (e.g., A-not-B task) used to understand differences across development by carefully controlling the environment (Piaget, 1954). Perhaps because emotional development was less amenable to experimental manipulation, emotional development was mostly studied using a more naturalistic and descriptive approach. As such, cognitive development was historically studied mostly by experimental paradigms, while emotional development was studied mostly by correlational work (Maccoby, 1984; Pérez-Edgar & Hastings, 2018). This led to a large corpus of empirical and theoretical work in each subfield emerging from different conceptual and methodological approaches, making it harder to integrate cognitive and emotional development theoretically and empirically. However, advancements in neuroscientific methods and increased understanding of the brain have demonstrated that cognitive and emotional development, not only interact but are deeply integrated in the individual throughout development (Bell & Wolfe, 2004; Lewis, 2005; Pessoa, 2008; Phelps, 2006). As will be discussed in this chapter, the brain networks associated with emotion and emotion regulation span across areas commonly studied in cognitive processes, illustrating that several cognitive functions such as attention, learning, memory, and cognitive control are deeply involved in emotional development.

Challenge III: Variations Across Development and Across Individuals

Developmental science aims to describe change over time as well as the mechanisms and consequences of change. The traditional goal of developmental science is to uncover laws concerning the development of human thought and behavior. In order to achieve this, developmental science commonly characterizes phenomena of interest by pooling information across people to summarize the data using measures of central tendency (e.g., average changes across age). Although this approach is highly valuable to characterize normative development, it often ignores the variability around the normative patterns of change. Importantly, most psychological processes have developmental trajectories that vary across individuals (Molenaar, 2004). As such, any individual developmental trajectory in the sample rarely represents the average trajectory.

Individual differences have important implications for our understanding of emotional development for practical and theoretical reasons. First, evidence suggests that many individual differences, for instance, in emotion expression, are stable over time, suggesting that they are not random noise. Second, many of the practical applications of the study of emotional development depend on the variability of emotion and emotion regulation across individuals as they are important predictors and markers of adjustment. For instance, identifying individuals at risk for later psychopathology or determining which factors predict developmental trajectories of resilience or risk relies on differences between individuals rather than norms (e.g., Kagan & Snidman, 1999; Mischel, Shoda, & Rodriguez, 1989; Moffitt et al., 2011). Finally, considering the diversity in the development of emotion is crucial to help elucidate some of the mechanisms behind the developmental outcomes. As such, the study of emotional development is faced with the challenge to not only consider both variations across normative development and variations across individuals but the need to integrate them into a framework that can account for both types of variation. We suggest that a neuroscientific approach can aid with this challenge by examining emotional development through an evolutionary biology lens that integrates species-typical and individual differences (Scarr, 1992). In this chapter, we will review empirical and theoretical literatures suggesting that individual variation due to constitutional factors such as temperament or early experiences have important implications for emotional development, including modifying the rate of developmental change. This growing literature leverages animal models to examine

how variations in evolutionarily conserved mechanisms shape emotional development across species.

We have summarized three important challenges to the study of emotional development. In addition, we have conceptually outlined some of the benefits of a neuroscientific approach to the study of emotional development. In the next section, we select a few examples from our work and others studying the development of the expression and regulation of fear and anxiety. The aim of the next section is to discuss examples that highlight the benefits of the neuroscientific approach, in particular, as it contributes to solving the challenges outlined above. Finally, we discuss outstanding issues and future directions with this approach. For each section below, we will first describe normative development, followed by a discussion on individual differences.

Neural Correlates of Emotion

Normative Development

Since the foundational work of Broca (1878/2015) and Papez (1937) on the limbic system, emotions have been thought to arise from subcortical brain structures. For example, individuals with damage to subcortical areas like the amygdala are reported to have abnormal fear reactions, including a marked reduction in the experience of fear, implying that the amygdala plays a critical role in the expression and experience of fear (Feinstein, Adolphs, Damasio, & Tranel, 2011). Most researchers would now agree that emotions are not localized to specific brain regions such as recent conceptualizations that propose that the amygdala is involved in processing of salient stimuli in general rather than exclusively fear-related stimuli (Adolphs, 2008).

However, the emphasis on subcortical circuits as fundamental for the development of emotion is reflected in the available literature. As such, we start by reviewing findings that focus on the development of relatively simplistic notions of mapping emotion to subcortical structures and functions with a focus on fear, anxiety, and the amygdala. We focus on fear, anxiety, and the amygdala because of the availability of developmental data with animal models as well as humans. In addition, the development of fear and anxiety have important implications as anxiety disorders are one of the most common forms of psychopathology, causing a significant burden to the individual and society (Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012).

Fear and fear-related behaviors are thought to emerge around 7 months after birth (Sroufe, 1977). This is evidenced by the emergence of fear-related behaviors such as expressions of distress in response to strangers or heights around this developmental period (Braungart-Rieker, Hill-Soderlund, & Karrass, 2010; Scarr & Salapatek, 1970). For example, fear-related behaviors toward strangers are observed at 7 months (Sroufe, 1977), increase through infancy, and remain relatively high during toddlerhood before starting to decline in childhood (Brooker et al., 2013).

Another source of evidence comes from the development of threat processing during infancy. For instance, infants around 7 months of age develop a normative attentional preference for threatening information (e.g., fearful or angry facial expressions) (LoBue & DeLoache, 2010; Nelson & Dolgin, 1985; Peltola, Leppänen, Palokangas, & Hietanen, 2008). Importantly, these changes in fear-related behaviors, including fear processing, develop during a developmental period in which fear becomes functionally relevant as infants become independently mobile and start to explore the environment and spend time away from the caregiver (Campos, Barrett, Lamb, Goldsmith, & Stenberg, 1983; Leppänen & Nelson, 2012).

Although evidence on the development of subcortical neural structures that may underlie the development of fear-related behaviors during infancy in humans is only emerging, nonhuman animal models can be highly informative. Other species show a similar developmental trajectory of fear-related behaviors (Sullivan & Holman, 2010). For example, rhesus monkeys do not display fear-related behaviors in the presence of a stranger until approximately 2–3 months

of age, the rough equivalent of 7–12 months of age in human infants (Kalin, Shelton, & Takahashi, 1991).

Neuroanatomical work suggests that these changes in behavior are associated with changes in subcortical regions, particularly the amygdala. For instance, in rhesus monkeys, the amygdala undergoes exponential developmental changes during the first months of life before stabilizing and displaying slower rates of change (Chareyron, Lavenex, Amaral, & Lavenex, 2012; Payne, Machado, Bliwise, & Bachevalier, 2010). Moreover, disruptions to the amygdala during this developmental period lead to abnormal threat detection and fear-related responses to strangers (Bauman, Lavenex, Mason, Capitanio, & Amaral, 2004; Raper, Wilson, Sanchez, Machado, & Bachevalier, 2013). Similarly, rat pups do not exhibit threat learning during their first 10 days of life, a developmental period approximately equivalent to the second half of the first year in humans (Haroutunian & Campbell, 1979; Sullivan, Hofer, & Brake, 1986). Elegant work has delineated the neural changes that accompany the expression of fear-related behaviors. This work suggests that around the 10th day of life, hormonal changes lead to transitions in the structure and function of the amygdala, which permit rat pups to display adult-like threat learning (Sullivan & Holman, 2010). In sum, in animal models, the developmental changes in structure and function of the amygdala largely parallel the timing of the development of fear-related behaviors.

These findings are consistent with the few human studies in which the amygdala displays rapid increases in volume during the first year of life, compared to the second year of life and other subcortical structures like hippocampus (Gilmore et al., 2012). However, continued increases in volume continue to be observed during early childhood, through adolescence and into young adulthood (Giedd et al., 1996; Goddings et al., 2014; Herting et al., 2018; Østby et al., 2009). Although evidence directly linking amygdala activity to fear-related behaviors during infancy is lacking, emerging data using fMRI suggests that the amygdala shows stronger responses to emotional stimuli during childhood and adolescence compared to adulthood (Decety, Michalska, & Kinzler, 2011; Gee, Humphreys, et al., 2013; Hare et al., 2008; Silvers et al., 2016; Silvers, Shu, Hubbard, Weber, & Ochsner, 2015; Swartz, Carrasco, Wiggins, Thomason, & Monk, 2014). This pattern of amygdala reactivity is in line with normative decreases in the expression and reports of fear and some forms of anxiety (e.g., separation anxiety) from early childhood into adolescence and adulthood (Gee, Humphreys, et al., 2013).

The limited experimental evidence concerning the development of subcortical areas in infancy comes from EEG measures. Although EEG does not directly index activity from subcortical structures (e.g., the amygdala), it is possible that the observed activity reflects neural circuits that involve the amygdala. EEG measures of threat processing in infancy reveal a pattern that parallels the development of fear expression and behavioral measures of threat processing. For example, at 7 months, infants begin to display a larger Nc (a component related to attention toward salient stimuli) to threat-related facial expressions compared to other facial expressions (Kobiella, Grossmann, Reid, & Striano, 2008; Leppänen, Moulson, Vogel-Farley, & Nelson, 2007; Peltola, Leppänen, Maki, & Hietanen, 2009). Interestingly, larger Nc to threats emerging at 7 months also occurs to only eye whites expressing fear, even in the absence of conscious perception (Jessen & Grossmann, 2014, 2016). The automatic and unconscious perception of threats is thought to occur in subcortical brain regions like the amygdala (Whalen, 2004). Together, these neuroimaging evidence suggests that infants, by the second half of their first year, process threat-related facial expressions like adults by subcortical mechanisms that operate automatically and outside of conscious awareness (Jessen & Grossmann, 2015).

These emerging data in humans, together with data from animal models, suggests that the amygdala is functional from early development and seems to have periods of change that coincide with the expression of fear-related behaviors. Importantly, this early developmental

period of rapid change in structure and function of the amygdala has been proposed as a period in which the amygdala is particularly susceptible to environmental factors leading to lasting changes in socioemotional development (Tottenham & Gabard-Durnam, 2017). In the next section, we review studies that suggest that individual differences in fear and anxiety are also associated with changes in the amygdala and have implications to the development of social behaviors and psychopathology.

Individual Differences

Variations in the expression of fear and anxious behaviors across development are often studied under the umbrella of constitutional and/or contextual factors. One line of work has focused on fearful temperament – the expression of wariness, distress, negative affect, or avoidance in response to novel stimuli (N. A. Fox, Henderson, Rubin, Calkins, & Schmidt, 2001). Fearful temperament is most often assessed in toddlerhood and has been most often studied as behavioral inhibition (N. A. Fox, Henderson, Marshall, Nichols, & Ghera, 2005). Importantly, fearful temperament is one of the best early predictors of later anxiety (Buss, 2011; Chronis-Tuscano et al., 2009; Pérez-Edgar & Fox, 2005; Schwartz, Snidman, & Kagan, 1999). A recent meta-analysis found that children characterized as temperamentally fearful are at a 7.5-fold increase in the odds of developing anxiety problems, especially social anxiety (Clauss & Blackford, 2012).

The antecedents of fearful temperament are early emerging and can be observed in 4-month-old infants' reactions to novelty. Infants who display high levels of motor behavior (e.g., thrashing their arms and legs), negative affect, as well as arching their back are more likely to become temperamentally fearful children (N. A. Fox, Snidman, Haas, Degnan, & Kagan, 2015). Kagan and Snidman (1991) proposed that these behaviors were caused by infants' amygdala responses in the face of novelty. Kagan suggested that these highly reactive infants, who were more likely to go on to become temperamentally fearful children, had a lower threshold for amygdala responsivity (Kagan, 1994). Later studies provided further evidence for this as children who were characterized as fearful in toddlerhood or as highly reactive as infants displayed more amygdala reactivity to faces as adolescents or adults (Pérez-Edgar et al., 2007; Schwartz et al., 2011; Schwartz, Wright, Shin, Kagan, & Rauch, 2003). Although, to our knowledge, no study has examined relations between amygdala activity and fearful temperament during infancy and early childhood, analogous findings have been found in animal models of fearful temperament. For example, an extensive literature suggests that in rhesus monkeys the amygdala plays a key role in the development of fearful temperament and anxiety (e.g., Birn et al., 2014; A. S. Fox et al., 2012; Kalin, Shelton, & Davidson, 2004; Oler et al., 2010).

Early life experiences are another widely studied source of individual differences in the development of fear and anxiety. Early adverse experiences place individuals at increased risk for psychopathology, including anxiety disorders (National Scientific Council on the Developing Child, 2010; Shonkoff et al., 2012). This literature also suggests that early experiences have implications for the development of the amygdala. A large corpus of evidence with animal models suggests that early experiences are related to the structure of the amygdala. For example, early stressors are predictive of larger amygdala volumes (e.g., Howell et al., 2014; Salm et al., 2004). Neuroimaging studies in humans have confirmed that, like in animal models, a wide range of early experiences are related to the functional and structural development of the amygdala.

These experiences range from normative variations in parenting (Gard et al., 2017), early life stress (Herringa et al., 2016; Suzuki et al., 2014), childhood poverty (Gianaros et al., 2008; Kim et al., 2013; Noble, Houston, Kan, & Sowell, 2012), to more extreme forms of early experiences such as maltreatment and social deprivation (Mehta et al., 2009; Olsavsky et al., 2013; Tottenham et al., 2010). In general, but with some exceptions, these studies find that early adverse experiences are related to increased

amygdala activity and larger amygdala volume. Importantly, in some instances the associated changes of amygdala function and structure are in turn associated with the known outcomes of early experiences such as increased anxiety (Tottenham et al., 2010).

Outstanding Issues and Future Directions

The first outstanding issue concerns the developmental trajectory of amygdala function. Although studies concur that adults display lower amygdala activity compared to children and adolescents, the evidence is mixed as to whether the amygdala displays a linear or a quadratic trajectory with adolescence being a period of increased amygdala activity (Gee, Humphreys, et al., 2013; Hare et al., 2008; Silvers et al., 2016, 2015). This difference has important implications as some models propose that adolescence is a unique period for the expression and regulation of emotions (Casey, 2015; Pattwell et al., 2012). One important factor to be considered is the task involved to elicit amygdala activity as the study finding linear decreases used explicit instructions to regulate emotion (Silvers et al., 2015, 2016), whereas others showing nonlinear changes involved implicit forms of emotion regulation (Hare et al., 2008) (see next section on Neural Correlates of Emotion Regulation). It is also worth noting that the amount of longitudinal data on the function of the amygdala is scarce. Future longitudinal studies with multiple assessments will be needed to better characterize the development of the amygdala's structure, function, and its role in emotional development.

Although our discussion has focused on the development of the amygdala and its role in the development of fear and anxiety, it is clear that the amygdala does not solely relate to fear-related behaviors, nor does it function in isolation. For example, amygdala activity has been related not only to the perception and expression of fear but also has been involved in other emotions such as disgust, happiness, sadness, and anger (Lindquist, Wager, Kober, Bliss-Moreau, & Barrett, 2012). This is in line with recent conceptualizations that suggest that amygdala is involved in the processing of salient stimuli more generally, which can be threatening, rewarding, or unpredictable (Adolphs, 2008).

Further complicating this picture, both animal and human works suggest that some of the regions commonly thought to be implicated in emotion, like the amygdala, are composed of subregions that have unique functions and are associated with specific patterns of connectivity (Etkin et al., 2004; Roy et al., 2009). For example, the basolateral subregion of the amygdala is most strongly functionally connected to temporal and frontal regions, while activity in the centromedial subregion is more closely related to activity in other subcortical structures (e.g., striatum) (Qin, Young, Supekar, Uddin, & Menon, 2012; Roy et al., 2009). Importantly, although some of this functional specificity is evident from early in development, the patterns of connectivity with the amygdala subregions become more segregated and specialized during development (Gabard-Durnam et al., 2014, 2018; Qin et al., 2012). On the other hand, other animal work suggests that subregions, which are commonly considered to be distinct, are functionally similar and closely work together to organize fear-related behaviors (A. S. Fox & Shackman, 2019).

Given this complexity and the lack of one-to-one mapping between brain structure and function to emotions, some authors posit that rather than trying to focus on specific brain regions, the emphasis should be in characterizing circuits or networks (Barrett, 2017; Casey, Galván, & Somerville, 2016; Pessoa, 2017). Crucially, many of these systems are not circumscribed to traditionally conceptualized emotional processes or brain areas (i.e., subcortical structures). Rather, they involve a wide variety of processes and brain areas, including sensorimotor and cognitive (e.g., memory and language) processes. As such, recent frameworks attempt to integrate and define emotion as the interaction across circuits (Barrett, 2017; Casey et al., 2016; Pessoa, 2017). Although these recent circuit- or network-based frameworks are potentially highly fruitful, little work has tested developmental changes using these

broader frameworks. There is emerging developmental work examining the brain networks related to emotional development, rather than specific brain areas, utilizing connectivity approaches. However, most of these studies have been focused on or conceptualized as examining emotion regulation rather than emotion expression based on the measures used. In the next section, we discuss the development of emotion regulation and its neural correlates, reviewing some of this emerging network-based literature.

Neural Correlates of Emotion Regulation

Normative Development

The development of emotion regulation begins in infancy, as the infant relies on automatic physiological processes and their caregiver to regulate their homeostatic and arousal states (Kopp, 1982; Sameroff, 2010). Children begin regulating distress in early infancy, mostly with aid of their caregivers, by using several strategies like distraction, which is accomplished by the early-appearing orienting response (Harman, Rothbart, & Posner, 1997). As children develop, they begin to internalize these strategies and start to use them on their own with more frequency to reduce distress and negative affect (Mangelsdorf, Shapiro, & Marzolf, 1995; Morasch & Bell, 2012; Rothbart, Ziaie, & O'Boyle, 1992); however, their effectiveness is limited during infancy (Stifter & Braungart, 1995), especially when regulating fear (Buss & Goldsmith, 1998).

During toddlerhood, children's deliberate use of such strategies shows a marked increase during the third year of life (e.g., the use of distraction; Cole et al., 2011; Kochanska, Coy, & Murray, 2001), which has been theorized as the developmental period in which self-regulation emerges (Kopp, 1982). This age also corresponds with considerable increases in the development of other cognitive processes such as executive function (Zelazo, 2004) and executive attention (Posner, Rothbart, Sheese, & Voelker, 2014; Rothbart, Sheese, Rueda, & Posner, 2011) believed to underlie the development of effortful control of behavior (e.g., attention; Ruff & Capozzoli, 2003). Moreover, the number of emotion regulation strategies used by children increases during childhood (Hodgins & Lander, 1997). Similarly, from childhood into adulthood, the use of more complex and adaptive emotion regulation strategies continues to increase (Zimmermann & Iwanski, 2014).

During these important changes in children's ability to use self-initiated emotion regulation strategies, it is assumed that not only the number of strategies increases but also the effectiveness with which these strategies are used improves through childhood to adulthood, allowing children to better regulate their emotions. For example, children's emotion regulation strategies are more effective at regulating fear responses at age 5 compared to age 2 (Morales et al., 2017). Likewise, the ability to reinterpret the meaning of an emotional event (i.e., reappraisal), a sophisticated emotion regulation strategy, improves with age from childhood to adulthood (Silvers et al., 2015, 2016). Although these behavioral examples provide initial evidence, a neuroscience approach allows examining the engagement of emotion-related and regulation processes (e.g., control of attention) that are not evident in behavior, especially at later developmental periods in which regulatory processes may mask emotional responses.

Emotion regulation is thought to involve several anterior areas of the brain including the medial prefrontal cortex (mPFC), ventrolateral PFC (vlPFC), dorsolateral PFC (dlPFC), and anterior cingulate cortex (ACC) (Etkin et al., 2015). In general, the brain areas associated with emotion regulation show a protracted developmental trajectory with important structural and functional changes during infancy and early childhood (Gilmore et al., 2012; Li et al., 2012) as well as preadolescence that last until the end of adolescence (Giedd et al., 1999; Gogtay et al., 2004; Lenroot & Giedd, 2006) and emerging adulthood (Taber-Thomas & Pérez-Edgar, 2015).

For example, in one of the few available longitudinal studies, the PFC showed significantly more volume change than subcortical structures

(e.g., amygdala and nucleus accumbens) from late childhood into adulthood (Mills et al., 2014), providing support for its protracted development compared to other subcortical structures involved in processing and expressions of emotion. The development of these areas also corresponds with the observed changes in behaviors that these areas are thought to support (Crone & Steinbeis, 2017; Ordaz, Foran, Velanova, & Luna, 2013). For example, effortful control, the ability to inhibit a prepotent response in order to enact another response, shows a similar protracted developmental trajectory with continued improvements in late childhood and adolescence. Moreover, the size of these brain areas, such as the ACC, is a significant predictor of effortful control across development, with the largest predictive power during the periods of rapid change (<12 years; Fjell et al., 2012). Similarly, EEG measures that reflect activity from these anterior areas (e.g., ACC) and index aspects of cognitive control also suggest a prolonged developmental period from early childhood to well into adulthood (Buzzell, Richards, et al., 2017; Hoyniak, 2017; Tamnes, Walhovd, Torstveit, Sells, & Fjell, 2013).

Importantly, recent studies examining the development of emotion regulation have focused on the brain networks that support emotion regulation, rather than studying single brain areas. These network approaches are one step closer to examining the process of regulation, moving beyond brain activity in isolated areas. For example, rather than examining if the amygdala is differentially active across conditions (e.g., emotion regulation vs. no emotion regulation), these approaches measure the degree to which activity in regulation-related areas is related to emotion-related areas – under the assumption that we utilize regulatory processes (e.g., PFC activity) to dampen our emotional reaction (e.g., amygdala activity). A first step in characterizing the development of emotion regulation using this approach is to characterize the developmental trajectories in the patterns of connectivity among the brain regions of interest. Given the paucity of developmental data on the structure and function of these networks, animal models as well as a growing literature characterizing these patterns of connectivity during rest in human infants are of great importance.

Animal models with rodents and non-human primates suggest largely reciprocal anatomical connections between the amygdala and the PFC, especially mPFC (Ghashghaei, Hilgetag, & Barbas, 2007; Öngür & Price, 2000). Developmentally, tracing studies in rodents show that these projections emerge during infancy or early childhood. The projections between the amygdala and PFC continue to develop during adolescence and early adulthood (Cressman et al., 2010). Importantly, functional networks do not perfectly overlap with structural networks (e.g., Honey et al., 2009). As such, several PFC areas, which do not share direct connections to the amygdala, can be involved in its regulation. For example, in non-human primates, the amygdala showed significant functional connectivity with areas that have direct anatomical connections to the amygdala-like mPFC as well as areas that lack direct anatomical connections to the amygdala-like dlPFC (Birn et al., 2014).

In humans, similar patterns of connectivity have been found from early development. Emerging work characterizing functional connectivity networks in humans at rest suggests that from infancy to adulthood, the functional connectivity with amygdala is largely stable and displays similar topology (Gabard-Durnam et al., 2014, 2018). This is in line with recent studies examining functional connectivity of brain networks at rest more broadly (i.e., not specific to the amygdala), in which adult-like topology of networks is found from early childhood and infancy (De Asis-Cruz, Bouyssi-Kobar, Evangelou, Vezina, & Limperopoulos, 2015; Gilmore, Knickmeyer, & Gao, 2018) and even before birth (van den Heuvel et al., 2018). One exception are networks involved in regulatory processes such as frontoparietal brain regions which show considerable changes in connectivity from infancy to childhood (Gao et al., 2009, 2014; Gao, Alcauter, Smith, Gilmore, & Lin, 2015) and from childhood to adolescence (Fair et al., 2009). Similarly, for emotion-related networks specifically, the connectivity between the

amygdala and the mPFC shows significant increases in connectivity from early childhood to adulthood (Gabard-Durnam et al., 2014; Qin et al., 2012). However, a recent accelerated cohort longitudinal study found significant decreases in functional and structural mPFC-amygdala connectivity from childhood to adulthood (Jalbrzikowski et al., 2017). Overall, these changes in connectivity are in line with the developmental changes observed in emotion regulation and the development of executive functions more broadly.

Other sources of evidence examining the neural bases of the development of emotion regulation using a network approach come from task-based studies. Recent models of the neural bases of emotion regulation make the useful distinction between implicit and explicit emotion regulation strategies (Braunstein et al., 2017; Etkin et al., 2015; Gyurak, Gross, & Etkin, 2011).

Implicit emotion regulation development Implicit emotion regulation strategies do not require instructions and occur automatically and largely outside of conscious awareness such as fear extinction, emotional conflict, and affect-biased attention. These emotion regulation strategies tend to activate ACC, mPFC, and vlPFC (Braunstein et al., 2017; Etkin et al., 2015). Support for the involvement of these areas comes from several sources of evidence. The original support for the involvement of these areas (e.g., mPFC) came from lesion studies with animal models examining fear extinction – the process of learning that a previously threatening stimulus is no longer dangerous (Milad & Quirk, 2012; Morgan, Romanski, & LeDoux, 1993). Later work in adults also involving fear conditioning confirmed the role of similar brain areas in the inhibition of fear in humans (Phelps, Delgado, Nearing, & LeDoux, 2004; Phelps & LeDoux, 2005). Other evidence comes from paradigms examining emotional conflict, in which emotional cues are distracting and incompatible or irrelevant to task demands such as the emotional Stroop (Mathews & MacLeod, 1985) or the emotional variants of the Go/No-go tasks (Casey et al., 2011; Hare et al., 2008).

Importantly, regulating affective stimuli is incidental to successfully carrying out goal-directed behavior in these paradigms. In studies using such paradigms, increased brain activation in the ACC and mPFC is commonly observed for conditions that involve conflict (Egner, Etkin, Gale, & Hirsch, 2007; Etkin, Egner, Peraza, Kandel, & Hirsch, 2006). Finally, affect-biased attention is the tendency to selectively attend to environmental cues that are pertinent to the one psychological state, facilitating the processing of stimuli in the environment and influencing one's emotional processes (Morales, Fu, & Pérez-Edgar, 2016; Todd, Cunningham, Anderson, & Thompson, 2012). Studies examining the neural bases of affect-biased attention have found greater activity in vlPFC for trials that involve orienting away from threatening facial expressions (Fu, Taber-Thomas, & Pérez-Edgar, 2017; Liu, Taber-Thomas, Fu, & Pérez-Edgar, 2018; Monk et al., 2006; Telzer et al., 2008).

Most studies examining developmental patterns have used emotional variants of the Go/No-go task. These studies find that the connectivity between the amygdala and mPFC becomes more adult-like with age (Gee, Humphreys, et al., 2013; Perlman & Pelphrey, 2011). Interestingly, the amygdala-mPFC connectivity in response to fearful faces shows a valence shift from positive connectivity during early childhood to negative connectivity during late adolescence and adulthood, paralleling normative decreases in amygdala reactivity to fear faces, increases in effortful control behaviors, decreases in anxiety, and improvement in emotion regulation across development (Gee, Humphreys, et al., 2013). The reason for this shift may be due to immature structural connectivity between the amygdala and the mPFC (Moreira & Silvers, 2018). As reviewed above, the PFC continues to structurally mature well into adulthood, and structural maturity has been associated with regulation of amygdala reactivity (Swartz et al., 2014). Another complementary hypothesis suggests that inputs from subcortical areas to the PFC lead to the

development of adult-like connectivity between the PFC and subcortical regions (Casey et al., 2019; Tottenham & Gabard-Durnam, 2017). This hypothesis is based on positive connectivity during early childhood and the animal work suggesting the emergence of subcortical to cortical before cortical to subcortical connections (Bouwmeester, Smits, & Ree, 2002; Bouwmeester, Wolterink, & Ree, 2002).

Although most studies examining emotion regulation have focused on characterizing influences between subcortical and cortical areas, recent studies suggest that connectivity between subcortical and subcortical areas may also play an important role in emotion regulation. A recent study found that amygdala and ventral striatum connectivity decreased with age from childhood to adulthood. Moreover this amygdala-ventral striatum connectivity was related to worse effortful control, especially to emotional cues (Heller, Cohen, Dreyfuss, & Casey, 2016). On the other hand, increased mPFC-amygdala connectivity was related with better effortful control to emotional cues. Moreover, mPFC-amygdala connectivity mediated the relation between amygdala-ventral striatum connectivity and effortful control. These findings suggest that subcortical to subcortical connectivity plays an important role in the development of emotion and emotion regulation. Furthermore, this study provides further support for the role of cortical to subcortical connectivity in the regulation of emotion (Heller et al., 2016).

Explicit emotion regulation development Explicit emotion regulation strategies involve the conscious desire to change one's emotions by following either intrinsic or extrinsic goals (e.g., following instructions). The principal explicit emotion regulation strategies are selective attention, distraction, and reappraisal (Ochsner & Gross, 2005). Selective attention involves actively attending to either the nonemotional features of the environment to downregulate emotion or to focus one's attention on the emotional features of the stimuli to upregulate emotion (Hariri, Bookheimer, & Mazziotta, 2000; Hariri, Mattay, Tessitore, Fera, & Weinberger, 2003). Another attention-related emotional regulation strategy is distraction, which involves becoming immersed in another task to limit or diminish attention to the emotional stimuli (Pessoa, McKenna, Gutierrez, & Ungerleider, 2002; Tracey et al., 2002). Finally, reappraisal involves reinterpreting the meaning of an emotional stimulus to change ones reaction to it (Gross, 1998). Studies examining these emotion regulation strategies generally find activation of frontal areas including vlPFC and dlPFC (as well as parietal areas commonly involved in the executive control network) (Buhle et al., 2014; Kohn et al., 2014).

Although there are far fewer studies examining the development of explicit emotion regulation strategies, recent studies have started to examine explicit emotion regulation strategies in children. These studies show that the ability to use reappraisal as an emotion regulation strategy increases with age from childhood to adulthood (DeCicco, O'Toole, & Dennis, 2014; Silvers et al., 2015, 2016, 2017). Evidence for these studies comes from two main neuroimaging modalities, EEG and fMRI.

EEG studies have examined the effects of reappraisal on the late positive potential (LPP), an ERP component thought to index facilitated attention to emotional stimuli (Cuthbert, Schupp, Bradley, Birbaumer, & Lang, 2000). In these studies, listening to a reappraisal story before observing an aversive picture significantly reduced the LPP (Dennis & Hajcak, 2009). These studies find that children's ability to use reappraisal increases with age (DeCicco et al., 2014). Moreover, the effect of reappraisal on the LPP seems to occur at later latencies than previously shown in adults, implying that the timing of the emotion regulation process may change with age (Dennis & Hajcak, 2009). Finally, the extent of reappraisal is related concurrently and longitudinally to children's ability to use adaptive emotion regulation strategies during emotional challenges (Babkirk, Rios, & Dennis, 2015).

Similarly, studies using fMRI find that the age-related increases in emotion regulation are

evident by reductions in feelings of negative affect and amygdala reactivity as well as increases in vlPFC when instructed to reappraise aversive stimuli. Further analyses suggest that age increases in the vlPFC mediate the relation between age and amygdala reactivity, suggesting that as individuals grow older, they are better able to recruit vlPFC during reappraisal to dampen amygdala activity (Silvers et al., 2016). In addition, the effects of the vlPFC on amygdala were stronger for individuals with a "mature" pattern of mPFC-amygdala connectivity. This suggests that the ability to regulate emotions via more cognitively advanced regulation strategies may depend on previously developing simpler forms of emotion regulation such as implicit emotion regulation strategies via mPFC-amygdala connectivity.

As a way of summarizing this section on the development of the neural bases on emotion regulation, we briefly review recent developmental models of the neural bases of emotion regulation. Recent developmental models propose that changes in the emotion and emotion regulation circuitry across development occur hierarchically (Casey, Heller, Gee, & Cohen, 2019; Tottenham & Gabard-Durnam, 2017). Namely, that connectivity changes take place from subcortical to subcortical, followed by subcortical to cortical, followed by cortical to subcortical, followed by cortical to cortical (Casey et al., 2019). Evidence of this developmental trajectory is only emerging, but these models highlight the main points of the literature reviewed above: (1) the role of subcortical to subcortical connectivity in emotion during childhood (Heller et al., 2016); (2) the potential role of subcortical areas (e.g., amygdala) driving the connectivity with the PFC and shaping the development of these cortical areas (Tottenham & Gabard-Durnam, 2017); (3) Finally, in addition to the more commonly studied role of the PFC to subcortical areas, they highlight the role of connectivity across cortical areas, especially when using more advanced and cognitively demanding emotion regulation strategies such as reappraisal (Casey et al., 2019; Silvers et al., 2016).

Individual Differences

As with individual differences in emotion, studies have also found considerable variation across individuals in their development of emotion regulation. Temperament is an important source of variation in emotion regulation. Although there is evidence of differences in emotion regulation based on fearful temperament, this evidence is limited almost exclusively to implicit forms of emotion regulation (e.g., Morales, Pérez-Edgar, & Buss, 2015; Morales, Taber-Thomas, & Pérez-Edgar, 2016; Penela, Walker, Degnan, Fox, & Henderson, 2015; Pérez-Edgar et al., 2010), and information about their neural bases is even more sparse. The studies that do exist suggest that individuals characterized as temperamentally fearful either early in development or concurrent with the neural measures show important differences in brain structure and function in areas associated with emotion regulation (Hardee et al., 2013; Taber-Thomas, Morales, Hillary, & Pérez-Edgar, 2016). For example, structurally, adults characterized as temperamentally fearful in early childhood had a larger mPFC (Schwartz et al., 2010), but smaller ACC (Sylvester et al., 2016). Connectivity analyses suggest that fearful temperament is associated with increased negative connectivity between the amygdala and ACC and dlPFC (Hardee et al., 2013; Roy et al., 2014). Notably, these findings closely parallel findings with animal models of fearful temperament and anxiety, suggesting an evolutionarily conserved network (Birn et al., 2014).

Furthermore, other studies suggest that fearful temperament is related to more activity in the dlPFC and mPFC when instantiating effortful control in an emotional context (Fu et al., 2017; Jarcho et al., 2013, 2014). Intriguingly, these differences in brain activity are typically evident in the absence of differences in performance, suggesting that fearful individuals may need to engage these control-related areas to compensate for higher levels of emotional reactivity (Fu et al., 2017; Jarcho et al., 2014). This interpretation is in line with the previously reviewed findings of increased amygdala reactivity in individuals characterized as temperamentally fearful in early

childhood (Pérez-Edgar et al., 2007; Schwartz et al., 2003). In addition, these findings also concur with studies examining EEG measures of effortful control, which find that fearful temperament is related to increased control-related ERP components such as error monitoring (Brooker & Buss, 2014; Buzzell, Troller-Renfree, et al., 2017; Lahat et al., 2014; McDermott et al., 2009).

Most studies investigating the development of individual differences in emotion regulation focus on the effects of early life experiences in the development of emotion regulation and its associated brain networks. Together, this literature suggests that in animal models as well as in humans, a broad range of early experiences are related to the functional and structural development of emotion regulation networks (Callaghan, Sullivan, Howell, & Tottenham, 2014; McEwen et al., 2015). These experiences range from normative variations in parenting (Kopala-Sibley et al., 2018), early life stress (Burghy et al., 2012; Hanson et al., 2012), and low socioeconomic status (Gianaros et al., 2007; Kim et al., 2013), to more extreme forms of early experiences such as maltreatment and social deprivation (Gee, Gabard-Durnam, et al., 2013; Hanson et al., 2013; McLaughlin et al., 2014; McLaughlin, Peverill, Gold, Alves, & Sheridan, 2015; Sheridan, Fox, Zeanah, McLaughlin, & Nelson, 2012). In general, this literature finds that more stressful experiences are associated with worse emotion regulation, increased amygdala reactivity, reduced structural measures in the PFC, and increased negative connectivity between mPFC and amygdala. Developmentally, studies from animal models as well as humans imply that early adversity may accelerate the development of the mPFC-amygdala connectivity (Callaghan et al., 2014). This is in line with models that suggest that early experiences shape the brain and physiological mechanisms involved in emotional responses and their regulation in an adaptive manner for that context by accelerating maturation (Del Giudice, Ellis, & Shirtcliff, 2011), albeit potentially by forgoing plasticity by closing sensitive periods earlier in development (Callaghan & Tottenham, 2016). More research is needed to reveal the functional implications of this accelerated developmental trajectory. It is possible that accelerated development comes at the expense of the development of other circuits also needed for emotional competence and may help explain the increased levels of psychopathology among children who experience high levels of early life adversity (Callaghan & Tottenham, 2016). Moreover, an accelerated developmental trajectory may lead to worse long-term health outcomes and premature aging (Belsky & Shalev, 2016).

Outstanding Issues and Future Directions

The first outstanding issue reflects the lack of evidence concerning developmental changes in the neural networks associated with emotion regulation early in development. As reviewed above, most developmental neuroscience work has focused on late childhood, early adolescence, and adulthood. This is in stark contrast to the behavioral work, in which there are decades of work on the early development of emotion regulation – work that implies that important changes in emotion regulation occur during the first years. To our knowledge, there is no neuroimaging work describing critical periods of the development of emotion regulation such as the emergence of independent forms of emotion regulation during toddlerhood and early childhood (Kopp, 1982, 1989). The lack of work during this developmental period probably stems from the difficulty of using neuroscientific measures during toddlerhood and early childhood. Neuroscientific measures are highly susceptible to motion, especially fMRI, and require a high degree of compliance. In addition, when studying developmental patterns other methodological considerations must be considered such as brain templates, skull thickness, etc. Although there is emerging work characterizing brain networks in infancy and toddlerhood during sleep (Gilmore et al., 2018; Graham et al., 2015), future research will require novel paradigms that allow the study of emotion-related processes (e.g., Graham, Fisher, & Pfeifer, 2013) during this important developmental period.

Another future avenue of research is the application of computational models to study the development of emotion regulation. Emotion regulation is a complex process composed of several cognitive processes, each of which is developing, potentially at different rates. A fruitful approach to understanding the development of emotion regulation is to focus on examining and differentiating the cognitive processes needed for successful emotion regulation. In adults, there are proposals (old and new) that highlight the utility of parsing the different cognitive processes involved in emotion regulation (Carver & Scheier, 1990; Etkin et al., 2015; Gyurak et al., 2011). However, to our knowledge, there has been little to no application of computational models to the development of emotion regulation. For example, although models differ in the specific cognitive components, most of these models agree that a key component is the ability to detect discrepancies between expected outcomes and current experiences, namely monitoring of prediction errors. There is considerable work in adults and in children examining this process, its development, and relations with the development of fear and anxiety (Buzzell, Troller-Renfree, Morales, & Fox, 2018; Meyer, 2017; Tamnes et al., 2013). Broadly, this line of research suggests that error monitoring increases from childhood to adulthood (Tamnes et al., 2013) and that increased error monitoring is related to increased levels of anxiety, especially clinical levels (Meyer, 2017). Moreover, increased error monitoring moderates the relation between early fearful temperament and later anxiety problems, such that fearful temperament is especially predictive of anxiety problems for children with increased error monitoring (Buzzell et al., 2018). Integrating this knowledge into an emotion regulation framework would be beneficial to our understanding how we control our emotions across development.

As with the study of the neural bases of emotion, there is a dearth of longitudinal studies. To our knowledge, all of the studies on the development of the brain networks associated with emotion regulation are cross-sectional. Future longitudinal studies in which the same individuals are assessed at multiple time points are needed in order to capture intraindividual variations as well as interindividual variations. For example, utilizing an accelerated cohort longitudinal design (Jalbrzikowski et al., 2017) would allow capturing within-person changes across a wide age range. Moreover, multiple time measures on the same individual will provide a better characterization of nonlinear changes as well as time periods that are highly susceptible to change. Finally, future studies should utilize multiple neural measures on the same individuals leveraging the strengths of each modality to better understand emotion regulation and its development.

Conclusion

In the present chapter, we propose that a neuroscientific approach provides a unique and valuable perspective to the study of emotional development. In particular, we suggest that a neuroscientific approach can contribute to three theoretical and methodological challenges to the study of emotional development. The first challenge involves the distinction between emotion and emotion regulation as separate processes. A neuroscientific approach can contribute to this challenge by providing tools and concepts that allow the examination of emotional development across several levels of analyses, aiding the differentiation of distinct processes and mechanisms. For example, in the literature reviewed, the amygdala was commonly involved in emotion-related processes such as fear-related behaviors. On the other hand, prefrontal areas (e.g., mPFC and vlPFC) were mostly involved in the regulation of emotion processes, including emerging connectivity data that implies that engagement in prefrontal regions regulates amygdala activity. Furthermore, different patterns of connectivity were involved with different forms of emotion regulation (i.e., explicit vs. implicit), implying different processes. Future studies leveraging a combination of neuroimaging methods (e.g., multimodal imaging) will further increase our understanding by not only characterizing the brain areas involved but also

the unique chronometry of emotion and emotion regulation processes.

The second challenge regards the common conceptualization of emotion and cognitive processes as categorically distinct processes. As reviewed in this chapter, several of the emotion regulation strategies and its associated brain networks emphasized the integration of emotion-related processes and other processes traditionally conceptualized as purely cognitive processes such as attention and cognitive control. Further supporting this integration, the developmental data reviewed in this chapter suggests that several emotion and emotion regulation processes follow a similar developmental trajectory as closely related cognitive processes. For instance, emotion regulation and cognitive control both rely heavily on prefrontal regions, and they follow a similar protracted developmental trajectory from early childhood into adulthood. Given the novelty of network or systems approaches to the study of the neural bases of emotional development, future studies should continue to characterize development of these networks. For instance, recent studies with adults utilizing multivariate pattern classification techniques have found that emotion processes involve highly distributed patterns of brain activation across cortical and subcortical areas (e.g., Kragel & LaBar, 2015). However, to our knowledge, no study has utilized similar pattern classification techniques to examine the development of emotion and emotion regulation.

The third challenge involves accounting for variation across development and across individuals. The literature reviewed highlights the fact that a neuroscientific approach situates the study of emotional development in a larger biological and evolutionary framework by using animal models and accounting for species-typical as well as individual variation. We also reviewed literature illustrating how a neuroscientific approach can further our understanding of how constitutional factors and experiences shape the brain networks that associated with the expression and regulation of emotion across development. Future longitudinal research utilizing a combination of methods is needed to increase our understanding on the development of the brain networks that underlie emotional development, including early identification of risk and the periods most susceptible to change.

We believe that a neuroscientific approach will continue to provide valuable contributions and help inform when and how to assist children's developmental trajectories to promote successful emotional development.

References

Adolphs, R. (2008). Fear, faces, and the human amygdala. *Current Opinion in Neurobiology, 18*(2), 166–172. https://doi.org/10.1016/j.conb.2008.06.006

Babkirk, S., Rios, V., & Dennis, T. A. (2015). The late positive potential predicts emotion regulation strategy use in school-aged children concurrently and two years later. *Developmental Science, 18*(5), 832–841.

Barrett, L. F. (2017). The theory of constructed emotion: An active inference account of interoception and categorization. *Social Cognitive and Affective Neuroscience, 12*(1), 1–23.

Bauman, M. D., Lavenex, P., Mason, W. A., Capitanio, J. P., & Amaral, D. G. (2004). The development of social behavior following neonatal amygdala lesions in rhesus monkeys. *Journal of Cognitive Neuroscience, 16*(8), 1388–1411. https://doi.org/10.1162/0898929042304741

Bell, M. A., & Wolfe, C. D. (2004). Emotion and cognition: An intricately bound developmental process. *Child Development, 75*(2), 366–370. https://doi.org/10.1111/j.1467-8624.2004.00679.x

Belsky, J., & Shalev, I. (2016). Contextual adversity, telomere erosion, pubertal development, and health: Two models of accelerated aging, or one? *Development and Psychopathology, 28*(4pt2), 1367–1383.

Birn, R. M., Shackman, A. J., Oler, J. A., Williams, L. E., McFarlin, D. R., Rogers, G. M., … Kalin, N. H. (2014). Evolutionarily conserved prefrontal-amygdalar dysfunction in early-life anxiety. *Molecular Psychiatry, 19*(8), 915–922. https://doi.org/10.1038/mp.2014.46

Bouwmeester, H., Smits, K., & Ree, J. M. V. (2002). Neonatal development of projections to the basolateral amygdala from prefrontal and thalamic structures in rat. *Journal of Comparative Neurology, 450*(3), 241–255. https://doi.org/10.1002/cne.10321

Bouwmeester, H., Wolterink, G., & Ree, J. M. V. (2002). Neonatal development of projections from the basolateral amygdala to prefrontal, striatal, and thalamic structures in the rat. *Journal of Comparative Neurology, 442*(3), 239–249. https://doi.org/10.1002/cne.10084

Braungart-Rieker, J. M., Hill-Soderlund, A. L., & Karrass, J. (2010). Fear and anger reactivity trajectories from 4

to 16 months: The roles of temperament, regulation, and maternal sensitivity. *Developmental Psychology, 46*(4), 791–804. https://doi.org/10.1037/a0019673

Braunstein, L. M., Gross, J. J., & Ochsner, K. N. (2017). Explicit and implicit emotion regulation: A multi-level framework. *Social Cognitive and Affective Neuroscience, 12*(10), 1545–1557.

Broca, P. (1878). Comparative anatomy of the cerebral convolutions: The great limbic lobe and the limbic fissure in the mammalian series. *Journal of Comparative Neurology, 523*(17), 2501–2554.

Brooker, R. J., & Buss, K. A. (2014). Toddler fearfulness is linked to individual differences in error-related negativity during preschool. *Developmental Neuropsychology, 39*(1), 1–8. https://doi.org/10.1080/87565641.2013.826661

Brooker, R. J., Buss, K. A., Lemery-Chalfant, K., Aksan, N., Davidson, R. J., & Goldsmith, H. H. (2013). The development of stranger fear in infancy and toddlerhood: Normative development, individual differences, antecedents, and outcomes. *Developmental Science*. https://doi.org/10.1111/desc.12058

Buhle, J. T., Silvers, J. A., Wager, T. D., Lopez, R., Onyemekwu, C., Kober, H., … Ochsner, K. N. (2014). Cognitive reappraisal of emotion: A meta-analysis of human neuroimaging studies. *Cerebral Cortex, 24*(11), 2981–2990.

Burghy, C. A., Stodola, D. E., Ruttle, P. L., Molloy, E. K., Armstrong, J. M., Oler, J. A., … Essex, M. J. (2012). Developmental pathways to amygdala-prefrontal function and internalizing symptoms in adolescence. *Nature Neuroscience, 15*(12), 1736.

Buss, K. A. (2011). Which fearful toddlers should we worry about? Context, fear regulation, and anxiety risk. *Developmental Psychology, 47*(3), 804–819. https://doi.org/10.1037/a0023227

Buss, K. A., & Goldsmith, H. H. (1998). Fear and anger regulation in infancy: Effects on the temporal dynamics of affective expression. *Child Development, 69*(2), 359–374. https://doi.org/10.1111/j.1467-8624.1998.tb06195.x

Buzzell, G. A., Richards, J. E., White, L. K., Barker, T. V., Pine, D. S., & Fox, N. A. (2017). Development of the error-monitoring system from ages 9–35: Unique insight provided by MRI-constrained source localization of EEG. *NeuroImage, 157*, 13–26. https://doi.org/10.1016/j.neuroimage.2017.05.045

Buzzell, G. A., Troller-Renfree, S. V., Barker, T. V., Bowman, L. C., Chronis-Tuscano, A., Henderson, H. A., … Fox, N. A. (2017). A neurobehavioral mechanism linking behaviorally inhibited temperament and later adolescent social anxiety. *Journal of the American Academy of Child & Adolescent Psychiatry, 56*(12), 1097–1105. https://doi.org/10.1016/j.jaac.2017.10.007

Buzzell, G. A., Troller-Renfree, S. V., Morales, S., & Fox, N. A. (2018). Relations between behavioral inhibition, cognitive control, and anxiety: Novel insights provided by parsing subdomains of cognitive control. In K. Pérez-Edgar & N. A. Fox (Eds.), *Behavioral inhibition: Integrating theory, research, and clinical perspectives* (pp. 213–235). Cham, Switzerland: Springer. https://doi.org/10.1007/978-3-319-98077-5_10

Callaghan, B. L., Sullivan, R. M., Howell, B., & Tottenham, N. (2014). The International Society for Developmental Psychobiology Sackler Symposium: Early adversity and the maturation of emotion circuits—A cross-species analysis. *Developmental Psychobiology, 56*(8), 1635–1650.

Callaghan, B. L., & Tottenham, N. (2016). The neuro-environmental loop of plasticity: A cross-species analysis of parental effects on emotion circuitry development following typical and adverse caregiving. *Neuropsychopharmacology, 41*(1), 163.

Campos, J. J., Barrett, K. C., Lamb, M. E., Goldsmith, H. H., & Stenberg, C. (1983). Socioemotional development. In M. M. Haith & J. J. Campos (Eds.), *Handbook of child psychology* (Vol. 2, 4th ed., pp. 783–915). New York, NY: Wiley.

Campos, J. J., Mumme, D. L., Kermoian, R., & Campos, R. G. (1994). A functionalist perspective on the nature of emotion. *Monographs of the Society for Research in Child Development, 59*(2/3), 284–303. https://doi.org/10.2307/1166150

Carver, C. S., & Scheier, M. F. (1990). Origins and functions of positive and negative affect: A control-process view. *Psychological Review, 97*(1), 19.

Casey, B. J. (2015). Beyond simple models of self-control to circuit-based accounts of adolescent behavior. *Annual Review of Psychology, 66*, 295–319.

Casey, B. J., Galván, A., & Somerville, L. H. (2016). Beyond simple models of adolescence to an integrated circuit-based account: A commentary. *Developmental Cognitive Neuroscience, 17*(Suppl. 1), 128–130.

Casey, B. J., Heller, A. S., Gee, D. G., & Cohen, A. O. (2019). Development of the emotional brain. *Neuroscience Letters*, 693, 29–34. https://doi.org/10.1016/j.neulet.2017.11.055

Casey, B. J., Somerville, L. H., Gotlib, I. H., Ayduk, O., Franklin, N. T., Askren, M. K., … Teslovich, T. (2011). Behavioral and neural correlates of delay of gratification 40 years later. *Proceedings of the National Academy of Sciences, 108*(36), 14998–15003.

Chareyron, L. J., Lavenex, P. B., Amaral, D. G., & Lavenex, P. (2012). Postnatal development of the amygdala: A stereological study in macaque monkeys. *Journal of Comparative Neurology, 520*(9), 1965–1984.

Chronis-Tuscano, A., Degnan, K. A., Pine, D. S., Perez-Edgar, K., Henderson, H. A., Diaz, Y., … Fox, N. A. (2009). Stable early maternal report of behavioral inhibition predicts lifetime social anxiety disorder in adolescence. *Journal of the American Academy of Child & Adolescent Psychiatry, 48*(9), 928–935. https://doi.org/10.1097/CHI.0b013e3181ae09df

Clauss, J. A., & Blackford, J. U. (2012). Behavioral inhibition and risk for developing social anxiety disorder: A meta-analytic study. *Journal of the American Academy of Child and Adolescent Psychiatry, 51*(10), 1066–1075.e1. https://doi.org/10.1016/j.jaac.2012.08.002

Cole, P. M., Martin, S. E., & Dennis, T. A. (2004). Emotion regulation as a scientific construct: Methodological challenges and directions for child development research. *Child Development, 75*(2), 317–333. https://doi.org/10.1111/j.1467-8624.2004.00673.x

Cole, P. M., Tan, P. Z., Hall, S. E., Zhang, Y., Crnic, K. A., Blair, C. B., & Li, R. (2011). Developmental changes in anger expression and attention focus: Learning to wait. *Developmental Psychology, 47*(4), 1078–1089. https://doi.org/10.1037/a0023813

Cressman, V. L., Balaban, J., Steinfeld, S., Shemyakin, A., Graham, P., Parisot, N., & Moore, H. (2010). Prefrontal cortical inputs to the basal amygdala undergo pruning during late adolescence in the rat. *Journal of Comparative Neurology, 518*(14), 2693–2709.

Crone, E. A., & Steinbeis, N. (2017). Neural perspectives on cognitive control development during childhood and adolescence. *Trends in Cognitive Sciences, 21*(3), 205–215.

Cuthbert, B. N., Schupp, H. T., Bradley, M. M., Birbaumer, N., & Lang, P. J. (2000). Brain potentials in affective picture processing: Covariation with autonomic arousal and affective report. *Biological Psychology, 52*(2), 95–111. https://doi.org/10.1016/S0301-0511(99)00044-7

Darwin, C. (1998). *The expression of the emotions in man and animals*. New York, NY: Oxford University Press.

De Asis-Cruz, J., Bouyssi-Kobar, M., Evangelou, I., Vezina, G., & Limperopoulos, C. (2015). Functional properties of resting state networks in healthy full-term newborns. *Scientific Reports, 5*, 17755.

Decety, J., Michalska, K. J., & Kinzler, K. D. (2011). The contribution of emotion and cognition to moral sensitivity: A neurodevelopmental study. *Cerebral Cortex, 22*(1), 209–220.

DeCicco, J. M., O'Toole, L. J., & Dennis, T. A. (2014). The late positive potential as a neural signature for cognitive reappraisal in children. *Developmental Neuropsychology, 39*(7), 497–515. https://doi.org/10.1080/87565641.2014.959171

Del Giudice, M., Ellis, B. J., & Shirtcliff, E. A. (2011). The adaptive calibration model of stress responsivity. *Neuroscience & Biobehavioral Reviews, 35*(7), 1562–1592. https://doi.org/10.1016/j.neubiorev.2010.11.007

Dennis, T. A., Buss, K. A., & Hastings, P. D. (2012). Physiological measures of emotion from a developmental perspective: State of the science. *Monographs of the Society for Research in Child Development, 77*(2), i–204.

Dennis, T. A., & Hajcak, G. (2009). The late positive potential: A neurophysiological marker for emotion regulation in children. *Journal of Child Psychology and Psychiatry, 50*(11), 1373–1383. https://doi.org/10.1111/j.1469-7610.2009.02168.x

Egner, T., Etkin, A., Gale, S., & Hirsch, J. (2007). Dissociable neural systems resolve conflict from emotional versus nonemotional distracters. *Cerebral Cortex, 18*(6), 1475–1484.

Eisenberg, N., Cumberland, A., Spinrad, T. L., Fabes, R. A., Shepard, S. A., Reiser, M., … Guthrie, I. K. (2001). The relations of regulation and emotionality to children's externalizing and internalizing problem behavior. *Child Development, 72*(4), 1112–1134. https://doi.org/10.1111/1467-8624.00337

Etkin, A., Büchel, C., & Gross, J. J. (2015). The neural bases of emotion regulation. *Nature Reviews Neuroscience, 16*(11), 693.

Etkin, A., Egner, T., Peraza, D. M., Kandel, E. R., & Hirsch, J. (2006). Resolving emotional conflict: A role for the rostral anterior cingulate cortex in modulating activity in the amygdala. *Neuron, 51*(6), 871–882.

Etkin, A., Klemenhagen, K. C., Dudman, J. T., Rogan, M. T., Hen, R., Kandel, E. R., & Hirsch, J. (2004). Individual differences in trait anxiety predict the response of the basolateral amygdala to unconsciously processed fearful faces. *Neuron, 44*(6), 1043–1055. https://doi.org/10.1016/j.neuron.2004.12.006

Fair, D. A., Cohen, A. L., Power, J. D., Dosenbach, N. U. F., Church, J. A., Miezin, F. M., … Petersen, S. E. (2009). Functional brain networks develop from a "local to distributed" organization. *PLoS Computational Biology, 5*(5), e1000381. https://doi.org/10.1371/journal.pcbi.1000381

Feinstein, J. S., Adolphs, R., Damasio, A., & Tranel, D. (2011). The human amygdala and the induction and experience of fear. *Current Biology, 21*(1), 34–38. https://doi.org/10.1016/j.cub.2010.11.042

Fjell, A. M., Walhovd, K. B., Brown, T. T., Kuperman, J. M., Chung, Y., Hagler, D. J., … Gruen, J. (2012). Multimodal imaging of the self-regulating developing brain. *Proceedings of the National Academy of Sciences, 109*(48), 19620–19625. https://doi.org/10.1073/pnas.1208243109

Fox, A. S., Oler, J. A., Shelton, S. E., Nanda, S. A., Davidson, R. J., Roseboom, P. H., & Kalin, N. H. (2012). Central amygdala nucleus (Ce) gene expression linked to increased trait-like Ce metabolism and anxious temperament in young primates. *Proceedings of the National Academy of Sciences of the United States of America, 109*(44), 18108–18113. https://doi.org/10.1073/pnas.1206723109

Fox, A. S., & Shackman, A. J. (2019). The central extended amygdala in fear and anxiety: Closing the gap between mechanistic and neuroimaging research. *Neuroscience Letters*, 693, 58–67. https://doi.org/10.1016/j.neulet.2017.11.056

Fox, N. A., Henderson, H. A., Marshall, P. J., Nichols, K. E., & Ghera, M. M. (2005). Behavioral inhibition: Linking biology and behavior within a developmental framework. *Annual Review of Psychology, 56*(1), 235–262. https://doi.org/10.1146/annurev.psych.55.090902.141532

Fox, N. A., Henderson, H. A., Rubin, K. H., Calkins, S. D., & Schmidt, L. A. (2001). Continuity and discontinuity of behavioral inhibition and exuberance: Psychophysiological and behavioral influences across the first four years of life. *Child Development, 72*(1), 1–21. https://doi.org/10.1111/1467-8624.00262

Fox, N. A., Snidman, N., Haas, S. A., Degnan, K. A., & Kagan, J. (2015). The relations between reactivity at 4 months and behavioral inhibition in the second year: Replication across three independent samples. *Infancy, 20*(1), 98–114. https://doi.org/10.1111/infa.12063

Fu, X., Taber-Thomas, B. C., & Pérez-Edgar, K. (2017). Frontolimbic functioning during threat-related attention: Relations to early behavioral inhibition and anxiety in children. *Biological Psychology, 122*, 98–109. https://doi.org/10.1016/j.biopsycho.2015.08.010

Gabard-Durnam, L. J., Flannery, J., Goff, B., Gee, D. G., Humphreys, K. L., Telzer, E., … Tottenham, N. (2014). The development of human amygdala functional connectivity at rest from 4 to 23 years: A cross-sectional study. *NeuroImage, 95*, 193–207.

Gabard-Durnam, L. J., O'Muircheartaigh, J., Dirks, H., Dean, D. C., III, Tottenham, N., & Deoni, S. (2018). Human amygdala functional network development: A cross-sectional study from 3 months to 5 years of age. *Developmental Cognitive Neuroscience, 34*, 63–74.

Gao, W., Alcauter, S., Elton, A., Hernandez-Castillo, C. R., Smith, J. K., Ramirez, J., & Lin, W. (2014). Functional network development during the first year: Relative sequence and socioeconomic correlations. *Cerebral Cortex, 25*(9), 2919–2928.

Gao, W., Alcauter, S., Smith, J. K., Gilmore, J. H., & Lin, W. (2015). Development of human brain cortical network architecture during infancy. *Brain Structure and Function, 220*(2), 1173–1186.

Gao, W., Zhu, H., Giovanello, K. S., Smith, J. K., Shen, D., Gilmore, J. H., & Lin, W. (2009). Evidence on the emergence of the brain's default network from 2-week-old to 2-year-old healthy pediatric subjects. *Proceedings of the National Academy of Sciences, 106*(16), 6790–6795. https://doi.org/10.1073/pnas.0811221106

Gard, A. M., Waller, R., Shaw, D. S., Forbes, E. E., Hariri, A. R., & Hyde, L. W. (2017). The long reach of early adversity: Parenting, stress, and neural pathways to antisocial behavior in adulthood. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging, 2*(7), 582–590.

Gee, D. G., Gabard-Durnam, L. J., Flannery, J., Goff, B., Humphreys, K. L., Telzer, E. H., … Tottenham, N. (2013). Early developmental emergence of human amygdala–prefrontal connectivity after maternal deprivation. *Proceedings of the National Academy of Sciences, 110*, 15638–15643, 201307893.

Gee, D. G., Humphreys, K. L., Flannery, J., Goff, B., Telzer, E. H., Shapiro, M., … Tottenham, N. (2013). A developmental shift from positive to negative connectivity in human amygdala–prefrontal circuitry. *The Journal of Neuroscience, 33*(10), 4584–4593. https://doi.org/10.1523/JNEUROSCI.3446-12.2013

Ghashghaei, H. T., Hilgetag, C. C., & Barbas, H. (2007). Sequence of information processing for emotions based on the anatomic dialogue between prefrontal cortex and amygdala. *NeuroImage, 34*(3), 905–923. https://doi.org/10.1016/j.neuroimage.2006.09.046

Gianaros, P. J., Horenstein, J. A., Cohen, S., Matthews, K. A., Brown, S. M., Flory, J. D., … Hariri, A. R. (2007). Perigenual anterior cingulate morphology covaries with perceived social standing. *Social Cognitive and Affective Neuroscience, 2*(3), 161–173. https://doi.org/10.1093/scan/nsm013

Gianaros, P. J., Horenstein, J. A., Hariri, A. R., Sheu, L. K., Manuck, S. B., Matthews, K. A., & Cohen, S. (2008). Potential neural embedding of parental social standing. *Social Cognitive and Affective Neuroscience, 3*(2), 91–96. https://doi.org/10.1093/scan/nsn003

Giedd, J. N., Blumenthal, J., Jeffries, N. O., Castellanos, F. X., Liu, H., Zijdenbos, A., … Rapoport, J. L. (1999). Brain development during childhood and adolescence: A longitudinal MRI study. *Nature Neuroscience, 2*(10), 861–863. https://doi.org/10.1038/13158

Giedd, J. N., Snell, J. W., Lange, N., Rajapakse, J. C., Casey, B. J., Kozuch, P. L., … Kaysen, D. (1996). Quantitative magnetic resonance imaging of human brain development: Ages 4–18. *Cerebral Cortex, 6*(4), 551–559.

Gilmore, J. H., Knickmeyer, R. C., & Gao, W. (2018). Imaging structural and functional brain development in early childhood. *Nature Reviews Neuroscience, 19*(3), 123.

Gilmore, J. H., Shi, F., Woolson, S. L., Knickmeyer, R. C., Short, S. J., Lin, W., … Shen, D. (2012). Longitudinal development of cortical and subcortical gray matter from birth to 2 years. *Cerebral Cortex, 22*(11), 2478–2485. https://doi.org/10.1093/cercor/bhr327

Goddings, A.-L., Mills, K. L., Clasen, L. S., Giedd, J. N., Viner, R. M., & Blakemore, S.-J. (2014). The influence of puberty on subcortical brain development. *NeuroImage, 88*, 242–251. https://doi.org/10.1016/j.neuroimage.2013.09.073

Gogtay, N., Giedd, J. N., Lusk, L., Hayashi, K. M., Greenstein, D., Vaituzis, A. C., … Thompson, P. M. (2004). Dynamic mapping of human cortical development during childhood through early adulthood. *Proceedings of the National Academy of Sciences of the United States of America, 101*(21), 8174–8179. https://doi.org/10.1073/pnas.0402680101

Graham, A. M., Fisher, P. A., & Pfeifer, J. H. (2013). What sleeping babies hear: A functional MRI study of interparental conflict and infants' emotion processing. *Psychological Science, 24*(5), 782–789.

Graham, A. M., Pfeifer, J. H., Fisher, P. A., Lin, W., Gao, W., & Fair, D. A. (2015). The potential of infant fMRI research and the study of early life stress as a promising exemplar. *Developmental Cognitive Neuroscience, 12*, 12–39. https://doi.org/10.1016/j.dcn.2014.09.005

Gross, J. J. (1998). Antecedent-and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology, 74*(1), 224.

Gross, J. J., & Thompson, R. A. (2007). Conceptual foundations for the field. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3–24). New York, NY: Guilford.

Gyurak, A., Gross, J. J., & Etkin, A. (2011). Explicit and implicit emotion regulation: A dual-process framework. *Cognition and Emotion, 25*(3), 400–412.

Hanson, J. L., Adluru, N., Chung, M. K., Alexander, A. L., Davidson, R. J., & Pollak, S. D. (2013). Early neglect is associated with alterations in white matter integrity and cognitive functioning. *Child Development*, n/a–n/a. https://doi.org/10.1111/cdev.12069

Hanson, J. L., Chung, M. K., Avants, B. B., Rudolph, K. D., Shirtcliff, E. A., Gee, J. C., … Pollak, S. D. (2012). Structural variations in prefrontal cortex mediate the relationship between early childhood stress and spatial working memory. *Journal of Neuroscience, 32*(23), 7917–7925. https://doi.org/10.1523/JNEUROSCI.0307-12.2012

Hardee, J. E., Benson, B. E., Bar-Haim, Y., Mogg, K., Bradley, B. P., Chen, G., … Pérez-Edgar, K. (2013). Patterns of neural connectivity during an attention bias task moderate associations between early childhood temperament and internalizing symptoms in young adulthood. *Biological Psychiatry, 74*(4), 273–279. https://doi.org/10.1016/j.biopsych.2013.01.036

Hare, T. A., Tottenham, N., Galvan, A., Voss, H. U., Glover, G. H., & Casey, B. J. (2008). Biological substrates of emotional reactivity and regulation in adolescence during an emotional go-nogo task. *Biological Psychiatry, 63*(10), 927–934. https://doi.org/10.1016/j.biopsych.2008.03.015

Hariri, A. R., Bookheimer, S. Y., & Mazziotta, J. C. (2000). Modulating emotional responses: Effects of a neocortical network on the limbic system. *Neuroreport, 11*(1), 43–48.

Hariri, A. R., Mattay, V. S., Tessitore, A., Fera, F., & Weinberger, D. R. (2003). Neocortical modulation of the amygdala response to fearful stimuli. *Biological Psychiatry, 53*(6), 494–501.

Harman, C., Rothbart, M. K., & Posner, M. I. (1997). Distress and attention interactions in early infancy. *Motivation and Emotion, 21*(1), 27–44.

Haroutunian, V., & Campbell, B. A. (1979). Emergence of interoceptive and exteroceptive control of behavior in rats. *Science, 205*(4409), 927–929. https://doi.org/10.1126/science.472715

Heller, A. S., Cohen, A. O., Dreyfuss, M. F., & Casey, B. J. (2016). Changes in cortico-subcortical and subcortico-subcortical connectivity impact cognitive control to emotional cues across development. *Social Cognitive and Affective Neuroscience, 11*(12), 1910–1918.

Herringa, R. J., Burghy, C. A., Stodola, D. E., Fox, M. E., Davidson, R. J., & Essex, M. J. (2016). Enhanced prefrontal-amygdala connectivity following childhood adversity as a protective mechanism against internalizing in adolescence. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging, 1*(4), 326–334.

Herting, M. M., Johnson, C., Mills, K. L., Vijayakumar, N., Dennison, M., Liu, C., … Whittle, S. (2018). Development of subcortical volumes across adolescence in males and females: A multisample study of longitudinal changes. *NeuroImage, 172,* 194–205.

Hodgins, M. J., & Lander, J. (1997). Children's coping with venipuncture. *Journal of Pain and Symptom Management, 13*(5), 274–285. https://doi.org/10.1016/S0885-3924(96)00328-4

Honey, C. J., Sporns, O., Cammoun, L., Gigandet, X., Thiran, J. P., Meuli, R., & Hagmann, P. (2009). Predicting human resting-state functional connectivity from structural connectivity. *Proceedings of the National Academy of Sciences, 106*(6), 2035–2040. https://doi.org/10.1073/pnas.0811168106

Howell, B. R., Grand, A. P., McCormack, K. M., Shi, Y., Laprarie, J. L., Maestripieri, D., … Sanchez, M. M. (2014). Early adverse experience increases emotional reactivity in juvenile rhesus macaques: Relation to amygdala volume. *Developmental Psychobiology, 56*(8), 1735–1746.

Hoyniak, C. (2017). Changes in the NoGo N2 event-related potential component across childhood: A systematic review and meta-analysis. *Developmental Neuropsychology, 42*(1), 1–24.

Jalbrzikowski, M., Larsen, B., Hallquist, M. N., Foran, W., Calabro, F., & Luna, B. (2017). Development of white matter microstructure and intrinsic functional connectivity between the amygdala and ventromedial prefrontal cortex: Associations with anxiety and depression. *Biological Psychiatry, 82*(7), 511–521.

James, W. (1884). What is an emotion? *Mind, 9*(34), 188–205.

Jarcho, J. M., Fox, N. A., Pine, D. S., Etkin, A., Leibenluft, E., Shechner, T., & Ernst, M. (2013). The neural correlates of emotion-based cognitive control in adults with early childhood behavioral inhibition. *Biological Psychology, 92*(2), 306–314. https://doi.org/10.1016/j.biopsycho.2012.09.008

Jarcho, J. M., Fox, N. A., Pine, D. S., Leibenluft, E., Shechner, T., Degnan, K. A., … Ernst, M. (2014). Enduring influence of early temperament on neural mechanisms mediating attention–emotion conflict in adults. *Depression and Anxiety, 31*(1), 53–62.

Jessen, S., & Grossmann, T. (2014). Unconscious discrimination of social cues from eye whites in infants. *Proceedings of the National Academy of Sciences, 111*(45), 16208–16213. https://doi.org/10.1073/pnas.1411333111

Jessen, S., & Grossmann, T. (2015). Neural signatures of conscious and unconscious emotional face processing in human infants. *Cortex, 64*, 260–270.

Jessen, S., & Grossmann, T. (2016). The developmental emergence of unconscious fear processing from eyes during infancy. *Journal of Experimental Child Psychology, 142*, 334–343. https://doi.org/10.1016/j.jecp.2015.09.009

Kagan, J. (1994). *Galen's prophecy: Temperament in human nature*. New York, NY: Basic Books.

Kagan, J., & Snidman, N. (1991). Infant predictors of inhibited and uninhibited profiles. *Psychological Science, 2*(1), 40–44. https://doi.org/10.1111/j.1467-9280.1991.tb00094.x

Kagan, J., & Snidman, N. (1999). Early childhood predictors of adult anxiety disorders. *Biological Psychiatry,*

46(11), 1536–1541. https://doi.org/10.1016/S0006-3223(99)00137-7

Kalin, N. H., Shelton, S. E., & Davidson, R. J. (2004). The role of the central nucleus of the amygdala in mediating fear and anxiety in the primate. *The Journal of Neuroscience, 24*(24), 5506–5515. https://doi.org/10.1523/JNEUROSCI.0292-04.2004

Kalin, N. H., Shelton, S. E., & Takahashi, L. K. (1991). Defensive behaviors in infant rhesus monkeys: Ontogeny and context-dependent selective expression. *Child Development, 62*(5), 1175–1183. https://doi.org/10.1111/j.1467-8624.1991.tb01598.x

Kessler, R. C., Petukhova, M., Sampson, N. A., Zaslavsky, A. M., & Wittchen, H.-U. (2012). Twelve-month and lifetime prevalence and lifetime morbid risk of anxiety and mood disorders in the United States. *International Journal of Methods in Psychiatric Research, 21*(3), 169–184. https://doi.org/10.1002/mpr.1359

Kim, P., Evans, G. W., Angstadt, M., Ho, S. S., Sripada, C. S., Swain, J. E., … Phan, K. L. (2013). Effects of childhood poverty and chronic stress on emotion regulatory brain function in adulthood. *Proceedings of the National Academy of Sciences, 110*, 18442–18447, 201308240.

Knudsen, E. I., Heckman, J. J., Cameron, J. L., & Shonkoff, J. P. (2006). Economic, neurobiological, and behavioral perspectives on building America's future workforce. *Proceedings of the National Academy of Sciences of the United States of America, 103*(27), 10155–10162. https://doi.org/10.1073/pnas.0600888103

Kobiella, A., Grossmann, T., Reid, V. M., & Striano, T. (2008). The discrimination of angry and fearful facial expressions in 7-month-old infants: An event-related potential study. *Cognition and Emotion, 22*(1), 134–146.

Kochanska, G., Coy, K. C., & Murray, K. T. (2001). The development of self-regulation in the first four years of life. *Child Development, 72*(4), 1091–1111. https://doi.org/10.1111/1467-8624.00336

Kohn, N., Eickhoff, S. B., Scheller, M., Laird, A. R., Fox, P. T., & Habel, U. (2014). Neural network of cognitive emotion regulation—An ALE meta-analysis and MACM analysis. *NeuroImage, 87*, 345–355.

Kopala-Sibley, D. C., Cyr, M., Finsaas, M. C., Orawe, J., Huang, A., Tottenham, N., & Klein, D. N. (2018). Early childhood parenting predicts late childhood brain functional connectivity during emotion perception and reward processing. *Child Development*. https://doi.org/10.1111/cdev.13126

Kopp, C. B. (1982). Antecedents of self-regulation: A developmental perspective. *Developmental Psychology, 18*(2), 199–214. https://doi.org/10.1037/0012-1649.18.2.199

Kopp, C. B. (1989). Regulation of distress and negative emotions: A developmental view. *Developmental Psychology, 25*(3), 343–354. https://doi.org/10.1037/0012-1649.25.3.343

Kragel, P. A., & LaBar, K. S. (2015). Multivariate neural biomarkers of emotional states are categorically distinct. *Social Cognitive and Affective Neuroscience, 10*(11), 1437–1448.

Lahat, A., Lamm, C., Chronis-Tuscano, A., Pine, D. S., Henderson, H. A., & Fox, N. A. (2014). Early behavioral inhibition and increased error monitoring predict later social phobia symptoms in childhood. *Journal of the American Academy of Child & Adolescent Psychiatry, 53*(4), 447–455. https://doi.org/10.1016/j.jaac.2013.12.019

LeDoux, J. E. (2012). Rethinking the emotional brain. *Neuron, 73*(4), 653–676. https://doi.org/10.1016/j.neuron.2012.02.004

LeDoux, J. E., & Brown, R. (2017). A higher-order theory of emotional consciousness. *Proceedings of the National Academy of Sciences, 114*, E2016–E2025, 201619316.

Lenroot, R. K., & Giedd, J. N. (2006). Brain development in children and adolescents: Insights from anatomical magnetic resonance imaging. *Neuroscience & Biobehavioral Reviews, 30*(6), 718–729. https://doi.org/10.1016/j.neubiorev.2006.06.001

Leppänen, J. M., Moulson, M. C., Vogel-Farley, V. K., & Nelson, C. A. (2007). An ERP study of emotional face processing in the adult and infant brain. *Child Development, 78*(1), 232–245. https://doi.org/10.1111/j.1467-8624.2007.00994.x

Leppänen, J. M., & Nelson, C. A. (2012). Early development of fear processing. *Current Directions in Psychological Science, 21*(3), 200–204. https://doi.org/10.1177/0963721411435841

Lewis, M. D. (2005). Bridging emotion theory and neurobiology through dynamic systems modeling. *Behavioral and Brain Sciences, 28*(02), 169–194. https://doi.org/10.1017/S0140525X0500004X

Li, G., Nie, J., Wang, L., Shi, F., Lin, W., Gilmore, J. H., & Shen, D. (2012). Mapping region-specific longitudinal cortical surface expansion from birth to 2 years of age. *Cerebral Cortex, 23*(11), 2724–2733.

Lindquist, K. A., Wager, T. D., Kober, H., Bliss-Moreau, E., & Barrett, L. F. (2012). The brain basis of emotion: A meta-analytic review. *Behavioral and Brain Sciences, 35*(3), 121–143. https://doi.org/10.1017/S0140525X11000446

Liu, P., Taber-Thomas, B. C., Fu, X., & Pérez-Edgar, K. E. (2018). Biobehavioral markers of attention bias modification in temperamental risk for anxiety: A randomized control trial. *Journal of the American Academy of Child & Adolescent Psychiatry, 57*(2), 103–110.

LoBue, V., & DeLoache, J. S. (2010). Superior detection of threat-relevant stimuli in infancy: Threat detection in infancy. *Developmental Science, 13*(1), 221–228. https://doi.org/10.1111/j.1467-7687.2009.00872.x

Maccoby, E. E. (1984). Socialization and developmental change. *Child Development, 55*(2), 317–328. https://doi.org/10.2307/1129945

Mangelsdorf, S. C., Shapiro, J. R., & Marzolf, D. (1995). Developmental and temperamental differences in emotion regulation in infancy. *Child Development, 66*(6), 1817–1828. https://doi.org/10.1111/j.1467-8624.1995.tb00967.x

Mathews, A., & MacLeod, C. (1985). Selective processing of threat cues in anxiety states. *Behaviour Research and Therapy, 23*(5), 563–569.

McDermott, J. M., Perez-Edgar, K., Henderson, H. A., Chronis-Tuscano, A., Pine, D. S., & Fox, N. A. (2009). A history of childhood Behavioral inhibition and enhanced response monitoring in adolescence are linked to clinical anxiety. *Biological Psychiatry, 65*(5), 445–448. https://doi.org/10.1016/j.biopsych.2008.10.043

McEwen, B. S., Bowles, N. P., Gray, J. D., Hill, M. N., Hunter, R. G., Karatsoreos, I. N., & Nasca, C. (2015). Mechanisms of stress in the brain. *Nature Neuroscience, 18*(10), 1353.

McLaughlin, K. A., Peverill, M., Gold, A. L., Alves, S., & Sheridan, M. A. (2015). Child maltreatment and neural systems underlying emotion regulation. *Journal of the American Academy of Child & Adolescent Psychiatry, 54*(9), 753–762.

McLaughlin, K. A., Sheridan, M. A., Winter, W., Fox, N. A., Zeanah, C. H., & Nelson, C. A. (2014). Widespread reductions in cortical thickness following severe early-life deprivation: A neurodevelopmental pathway to attention-deficit/hyperactivity disorder. *Biological Psychiatry, 76*(8), 629–638.

Mehta, M. A., Golembo, N. I., Nosarti, C., Colvert, E., Mota, A., Williams, S. C., … Sonuga-Barke, E. J. (2009). Amygdala, hippocampal and corpus callosum size following severe early institutional deprivation: The English and Romanian Adoptees study pilot. *Journal of Child Psychology and Psychiatry, 50*(8), 943–951.

Meyer, A. (2017). A biomarker of anxiety in children and adolescents: A review focusing on the error-related negativity (ERN) and anxiety across development. *Developmental Cognitive Neuroscience, 27*, 58–68. https://doi.org/10.1016/j.dcn.2017.08.001

Milad, M. R., & Quirk, G. J. (2012). Fear extinction as a model for translational neuroscience: Ten years of progress. *Annual Review of Psychology, 63*, 129–151.

Mischel, W., Shoda, Y., & Rodriguez, M. I. (1989). Delay of gratification in children. *Science, 244*(4907), 933–938. https://doi.org/10.1126/science.2658056

Mills, K. L., Goddings, A.-L., Clasen, L. S., Giedd, J. N., & Blakemore, S.-J. (2014). The developmental mismatch in structural brain maturation during adolescence. Developmental Neuroscience, 36(3–4), 147–160.

Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., … Caspi, A. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the National Academy of Sciences of the United States of America, 108*(7), 2693–2698. https://doi.org/10.1073/pnas.1010076108

Molenaar, P. C. (2004). A manifesto on psychology as idiographic science: Bringing the person back into scientific psychology, this time forever. *Measurement, 2*(4), 201–218.

Monk, C. S., Nelson, E. E., McClure, E. B., Mogg, K., Bradley, B. P., Leibenluft, E., … Pine, D. S. (2006). Ventrolateral prefrontal cortex activation and attentional bias in response to angry faces in adolescents with generalized anxiety disorder. *The American Journal of Psychiatry, 163*(6), 1091–1097. https://doi.org/10.1176/appi.ajp.163.6.1091

Morales, S., Fu, X., & Pérez-Edgar, K. E. (2016). A developmental neuroscience perspective on affect-biased attention. *Developmental Cognitive Neuroscience, 21*, 26–41. https://doi.org/10.1016/j.dcn.2016.08.001

Morales, S., Pérez-Edgar, K. E., & Buss, K. A. (2015). Attention biases towards and away from threat mark the relation between early dysregulated fear and the later emergence of social withdrawal. *Journal of Abnormal Child Psychology, 43*(6), 1067–1078. https://doi.org/10.1007/s10802-014-9963-9

Morales, S., Ram, N., Buss, K. A., Cole, P. M., Helm, J. L., & Chow, S.-M. (2017). Age-related changes in the dynamics of fear-related regulation in early childhood. *Developmental Science, 21*, e12633. https://doi.org/10.1111/desc.12633

Morales, S., Taber-Thomas, B. C., & Pérez-Edgar, K. E. (2016). Patterns of attention to threat across tasks in behaviorally inhibited children at risk for anxiety. *Developmental Science.* https://doi.org/10.1111/desc.12391

Morasch, K. C., & Bell, M. A. (2012). Self-regulation of negative affect at 5 and 10 months. *Developmental Psychobiology, 54*(2), 215–221. https://doi.org/10.1002/dev.20584

Moreira, J. F. G., & Silvers, J. A. (2018). In due time: Neurodevelopmental considerations in the study of emotion regulation. In P. M. Cole & T. Hollenstein (Eds.), *Emotion regulation* (pp. 111–134). New York, NY: Routledge.

Morgan, M. A., Romanski, L. M., & LeDoux, J. E. (1993). Extinction of emotional learning: Contribution of medial prefrontal cortex. *Neuroscience Letters, 163*(1), 109–113.

National Scientific Council on the Developing Child. (2010). Persistent fear and anxiety can affect young children. Retrieved November 15, 2018, from https://developingchild.harvard.edu/resources/persistent-fear-and-anxiety-can-affect-young-childrens-learning-and-development/

Nelson, C. A., & Dolgin, K. G. (1985). The generalized discrimination of facial expressions by seven-month-old infants. *Child Development, 56*(1), 58. https://doi.org/10.2307/1130173

Nelson, C. A., Thomas, K., & DeHaan, M. (2008). Neural bases of cognitive development. In W. Damon & R. M. Lerner (Eds.), *Child and adolescent development: An advanced course* (pp. 19–51). Hoboken, NJ: Wiley.

Noble, K. G., Houston, S. M., Kan, E., & Sowell, E. R. (2012). Neural correlates of socioeconomic status in the developing human brain. *Developmental Science, 15*(4), 516–527. https://doi.org/10.1111/j.1467-7687.2012.01147.x

Ochsner, K. N., & Gross, J. J. (2005). The cognitive control of emotion. *Trends in Cognitive Sciences, 9*(5), 242–249.

Oler, J. A., Fox, A. S., Shelton, S. E., Rogers, J., Dyer, T. D., Davidson, R. J., … Kalin, N. H. (2010). Amygdalar and hippocampal substrates of anxious temperament differ in their heritability. *Nature, 466*(7308), 864–868. https://doi.org/10.1038/nature09282

Olsavsky, A. K., Telzer, E. H., Shapiro, M., Humphreys, K. L., Flannery, J., Goff, B., & Tottenham, N. (2013). Indiscriminate amygdala response to mothers and strangers after early maternal deprivation. *Biological Psychiatry, 74*(11), 853–860. https://doi.org/10.1016/j.biopsych.2013.05.025

Ordaz, S. J., Foran, W., Velanova, K., & Luna, B. (2013). Longitudinal growth curves of brain function underlying inhibitory control through adolescence. *Journal of Neuroscience, 33*(46), 18109–18124. https://doi.org/10.1523/JNEUROSCI.1741-13.2013

Öngür, D., & Price, J. L. (2000). The organization of networks within the orbital and medial prefrontal cortex of rats, monkeys and humans. *Cerebral Cortex, 10*(3), 206–219.

Østby, Y., Tamnes, C. K., Fjell, A. M., Westlye, L. T., Due-Tønnessen, P., & Walhovd, K. B. (2009). Heterogeneity in subcortical brain development: A structural magnetic resonance imaging study of brain maturation from 8 to 30 years. *Journal of Neuroscience, 29*(38), 11772–11782.

Papez, J. W. (1937). A proposed mechanism of emotion. *Archives of Neurology and Psychiatry, 38*(4), 725–743.

Pattwell, S. S., Duhoux, S., Hartley, C. A., Johnson, D. C., Jing, D., Elliott, M. D., … Lee, F. S. (2012). Altered fear learning across development in both mouse and human. *Proceedings of the National Academy of Sciences, 109*(40), 16318–16323. https://doi.org/10.1073/pnas.1206834109

Payne, C., Machado, C. J., Bliwise, N. G., & Bachevalier, J. (2010). Maturation of the hippocampal formation and amygdala in *Macaca mulatta*: A volumetric magnetic resonance imaging study. *Hippocampus, 20*(8), 922–935. https://doi.org/10.1002/hipo.20688

Peltola, M. J., Leppänen, J. M., Maki, S., & Hietanen, J. K. (2009). Emergence of enhanced attention to fearful faces between 5 and 7 months of age. *Social Cognitive and Affective Neuroscience, 4*(2), 134–142. https://doi.org/10.1093/scan/nsn046

Peltola, M. J., Leppänen, J. M., Palokangas, T., & Hietanen, J. K. (2008). Fearful faces modulate looking duration and attention disengagement in 7-month-old infants. *Developmental Science, 11*(1), 60–68. https://doi.org/10.1111/j.1467-7687.2007.00659.x

Penela, E. C., Walker, O. L., Degnan, K. A., Fox, N. A., & Henderson, H. A. (2015). Early behavioral inhibition and emotion regulation: Pathways toward social competence in middle childhood. *Child Development, 86*(4), 1227–1240.

Pérez-Edgar, K. E., Bar-Haim, Y., McDermott, J. M., Chronis-Tuscano, A., Pine, D. S., & Fox, N. A. (2010). Attention biases to threat and behavioral inhibition in early childhood shape adolescent social withdrawal. *Emotion, 10*(3), 349–357. https://doi.org/10.1037/a0018486

Pérez-Edgar, K. E., & Fox, N. A. (2005). Temperament and anxiety disorders. *Child and Adolescent Psychiatric Clinics of North America, 14*(4), 681–706. https://doi.org/10.1016/j.chc.2005.05.008

Pérez-Edgar, K., & Hastings, P. (2018). Emotion development from an experimental and individual differences lens. In J. T. Wixted (Ed.), *Stevens' handbook of experimental psychology and cognitive neuroscience* (4th ed., Vol. 4, pp. 289–322).

Pérez-Edgar, K. E., Roberson-Nay, R., Hardin, M. G., Poeth, K., Guyer, A. E., Nelson, E. E., … Ernst, M. (2007). Attention alters neural responses to evocative faces in behaviorally inhibited adolescents. *NeuroImage, 35*(4), 1538–1546. https://doi.org/10.1016/j.neuroimage.2007.02.006

Perlman, S. B., & Pelphrey, K. A. (2011). Developing connections for affective regulation: Age-related changes in emotional brain connectivity. *Journal of Experimental Child Psychology, 108*(3), 607–620.

Pessoa, L. (2008). On the relationship between emotion and cognition. *Nature Reviews Neuroscience, 9*(2), 148–158. https://doi.org/10.1038/nrn2317

Pessoa, L. (2017). A network model of the emotional brain. *Trends in Cognitive Sciences, 21*(5), 357–371. https://doi.org/10.1016/j.tics.2017.03.002

Pessoa, L., McKenna, M., Gutierrez, E., & Ungerleider, L. G. (2002). Neural processing of emotional faces requires attention. *Proceedings of the National Academy of Sciences, 99*(17), 11458–11463.

Phelps, E. A. (2006). Emotion and cognition: Insights from studies of the human amygdala. *Annual Review of Psychology, 57*(1), 27–53. https://doi.org/10.1146/annurev.psych.56.091103.070234

Phelps, E. A., Delgado, M. R., Nearing, K. I., & LeDoux, J. E. (2004). Extinction learning in humans. *Neuron, 43*(6), 897–905. https://doi.org/10.1016/j.neuron.2004.08.042

Phelps, E. A., & LeDoux, J. E. (2005). Contributions of the amygdala to emotion processing: From animal models to human behavior. *Neuron, 48*(2), 175–187. https://doi.org/10.1016/j.neuron.2005.09.025

Piaget, J. (1954). *The Construction of Reality in the Child* (Cook, M, trans.). New York, NY, US: Basic Books.

Pine, D. S., & Fox, N. A. (2015). Childhood antecedents and risk for adult mental disorders. *Annual Review of Psychology, 66*(1), 459–485. https://doi.org/10.1146/annurev-psych-010814-015038

Posner, M. I., Rothbart, M. K., Sheese, B. E., & Voelker, P. (2014). Developing attention: Behavioral and brain mechanisms. *Advances in Neuroscience, 2014*, e405094. https://doi.org/10.1155/2014/405094

Qin, S., Young, C. B., Supekar, K., Uddin, L. Q., & Menon, V. (2012). Immature integration and segregation of emotion-related brain circuitry in young children. *Proceedings of the National Academy of Sciences, 109*(20), 7941–7946.

Raper, J., Wilson, M., Sanchez, M., Machado, C. J., & Bachevalier, J. (2013). Pervasive alterations of emotional and neuroendocrine responses to an acute stressor after neonatal amygdala lesions in rhesus monkeys. *Psychoneuroendocrinology, 38*(7), 1021–1035. https://doi.org/10.1016/j.psyneuen.2012.10.008

Rothbart, M. K., Sheese, B. E., Rueda, M. R., & Posner, M. I. (2011). Developing mechanisms of self-regulation in early life. *Emotion Review, 3*(2), 207–213. https://doi.org/10.1177/1754073910387943

Rothbart, M. K., Ziaie, H., & O'Boyle, C. G. (1992). Self-regulation and emotion in infancy. *New Directions for Child and Adolescent Development, 1992*(55), 7–23.

Roy, A. K., Benson, B. E., Degnan, K. A., Perez-Edgar, K., Pine, D. S., Fox, N. A., & Ernst, M. (2014). Alterations in amygdala functional connectivity reflect early temperament. *Biological Psychology, 103*, 248–254.

Roy, A. K., Shehzad, Z., Margulies, D. S., Kelly, A. M. C., Uddin, L. Q., Gotimer, K., … Milham, M. P. (2009). Functional connectivity of the human amygdala using resting state fMRI. *NeuroImage, 45*(2), 614–626. https://doi.org/10.1016/j.neuroimage.2008.11.030

Ruff, H. A., & Capozzoli, M. C. (2003). Development of attention and distractibility in the first 4 years of life. *Developmental Psychology, 39*(5), 877–890. https://doi.org/10.1037/0012-1649.39.5.877

Salm, A. K., Pavelko, M., Krouse, E. M., Webster, W., Kraszpulski, M., & Birkle, D. L. (2004). Lateral amygdaloid nucleus expansion in adult rats is associated with exposure to prenatal stress. *Developmental Brain Research, 148*(2), 159–167. https://doi.org/10.1016/j.devbrainres.2003.11.005

Sameroff, A. (2010). A unified theory of development: A dialectic integration of nature and nurture. *Child Development, 81*(1), 6–22. https://doi.org/10.1111/j.1467-8624.2009.01378.x

Scarr, S. (1992). Developmental theories for the 1990s: Development and individual differences. *Child Development, 63*(1), 1–19. https://doi.org/10.1111/j.1467-8624.1992.tb03591.x

Scarr, S., & Salapatek, P. (1970). Patterns of fear development during infancy. *Merrill-Palmer Quarterly of Behavior and Development, 16*(1), 53–90.

Schwartz, C. E., Kunwar, P. S., Greve, D. N., Kagan, J., Snidman, N. C., & Bloch, R. B. (2011). A phenotype of early infancy predicts reactivity of the amygdala in male adults. *Molecular Psychiatry, 17*(10), 1042–1050. https://doi.org/10.1038/mp.2011.96

Schwartz, C. E., Kunwar, P. S., Greve, D. N., Moran, L. R., Viner, J. C., Covino, J. M., … Wallace, S. R. (2010). Structural differences in adult orbital and ventromedial prefrontal cortex are predicted by 4-month infant temperament. *Archives of General Psychiatry, 67*(1), 78–84. https://doi.org/10.1001/archgenpsychiatry.2009.171

Schwartz, C. E., Snidman, N., & Kagan, J. (1999). Adolescent social anxiety as an outcome of inhibited temperament in childhood. *Journal of the American Academy of Child and Adolescent Psychiatry, 38*(8), 1008–1015. https://doi.org/10.1097/00004583-199908000-00017

Schwartz, C. E., Wright, C. I., Shin, L. M., Kagan, J., & Rauch, S. L. (2003). Inhibited and uninhibited infants "grown up": Adult amygdalar response to novelty. *Science, 300*(5627), 1952–1953. https://doi.org/10.1126/science.1083703

Sheridan, M. A., Fox, N. A., Zeanah, C. H., McLaughlin, K. A., & Nelson, C. A. (2012). Variation in neural development as a result of exposure to institutionalization early in childhood. *Proceedings of the National Academy of Sciences, 109*(32), 12927–12932.

Shonkoff, J. P., Garner, A. S., Siegel, B. S., Dobbins, M. I., Earls, M. F., McGuinn, L., … Care, D. (2012). The lifelong effects of early childhood adversity and toxic stress. *Pediatrics, 129*(1), e232–e246.

Silvers, J. A., Insel, C., Powers, A., Franz, P., Helion, C., Martin, R., … Ochsner, K. N. (2017). The transition from childhood to adolescence is marked by a general decrease in amygdala reactivity and an affect-specific ventral-to-dorsal shift in medial prefrontal recruitment. *Developmental Cognitive Neuroscience, 25*, 128–137.

Silvers, J. A., Insel, C., Powers, A., Franz, P., Helion, C., Martin, R. E., … Ochsner, K. N. (2016). vlPFC–vmPFC–amygdala interactions underlie age-related differences in cognitive regulation of emotion. *Cerebral Cortex, 27*(7), 3502–3514.

Silvers, J. A., Shu, J., Hubbard, A. D., Weber, J., & Ochsner, K. N. (2015). Concurrent and lasting effects of emotion regulation on amygdala response in adolescence and young adulthood. *Developmental Science, 18*(5), 771–784.

Sroufe, L. A. (1977). Wariness of strangers and the study of infant development. *Child Development, 48*(3), 731–746. https://doi.org/10.1111/1467-8624.ep10402182

Stifter, C. A., & Braungart, J. M. (1995). The regulation of negative reactivity in infancy: Function and development. *Developmental Psychology, 31*(3), 448–455. https://doi.org/10.1037/0012-1649.31.3.448

Sullivan, R. M., Hofer, M. A., & Brake, S. C. (1986). Olfactory-guided orientation in neonatal rats is enhanced by a conditioned change in behavioral state. *Developmental Psychobiology, 19*(6), 615–623. https://doi.org/10.1002/dev.420190612

Sullivan, R. M., & Holman, P. J. (2010). Transitions in sensitive period attachment learning in infancy: The role of corticosterone. *Neuroscience & Biobehavioral Reviews, 34*(6), 835–844. https://doi.org/10.1016/j.neubiorev.2009.11.010

Suzuki, H., Luby, J. L., Botteron, K. N., Dietrich, R., McAvoy, M. P., & Barch, D. M. (2014). Early life stress and trauma and enhanced limbic activation to emotionally valenced faces in depressed and healthy children. *Journal of the American Academy of Child & Adolescent Psychiatry, 53*(7), 800–813.e10. https://doi.org/10.1016/j.jaac.2014.04.013

Swartz, J. R., Carrasco, M., Wiggins, J. L., Thomason, M. E., & Monk, C. S. (2014). Age-related changes in the structure and function of prefrontal cortex–amyg-

dala circuitry in children and adolescents: A multimodal imaging approach. *NeuroImage, 86*, 212–220. https://doi.org/10.1016/j.neuroimage.2013.08.018

Sylvester, C. M., Barch, D. M., Harms, M. P., Belden, A. C., Oakberg, T. J., Gold, A. L., … Pine, D. S. (2016). Early childhood behavioral inhibition predicts cortical thickness in adulthood. *Journal of the American Academy of Child and Adolescent Psychiatry, 55*(2), 122–129. e1. https://doi.org/10.1016/j.jaac.2015.11.007

Taber-Thomas, B. C., Morales, S., Hillary, F. G., & Pérez-Edgar, K. E. (2016). Altered topography of intrinsic functional connectivity in childhood risk for social anxiety. *Depression and Anxiety, 33*(11), 995–1004.

Taber-Thomas, B. C., & Pérez-Edgar, K. E. (2015). Emerging adulthood brain development. In J. Arnett Jensen (Ed.), *The Oxford handbook of emerging adulthood* (pp. 126–141). New York, NY: Oxford University Press.

Tamnes, C. K., Walhovd, K. B., Torstveit, M., Sells, V. T., & Fjell, A. M. (2013). Performance monitoring in children and adolescents: A review of developmental changes in the error-related negativity and brain maturation. *Developmental Cognitive Neuroscience, 6*, 1–13. https://doi.org/10.1016/j.dcn.2013.05.001

Telzer, E. H., Mogg, K., Bradley, B. P., Mai, X., Ernst, M., Pine, D. S., & Monk, C. S. (2008). Relationship between trait anxiety, prefrontal cortex, and attention bias to angry faces in children and adolescents. *Biological Psychology, 79*(2), 216–222. https://doi.org/10.1016/j.biopsycho.2008.05.004

Thompson, R. A. (1994). Emotion regulation: A theme in search of definition. *Monographs of the Society for Research in Child Development, 59*(2/3), 25–52. https://doi.org/10.2307/1166137

Todd, R. M., Cunningham, W. A., Anderson, A. K., & Thompson, E. (2012). Affect-biased attention as emotion regulation. *Trends in Cognitive Sciences, 16*(7), 365–372. https://doi.org/10.1016/j.tics.2012.06.003

Tottenham, N., & Gabard-Durnam, L. J. (2017). The developing amygdala: A student of the world and a teacher of the cortex. *Current Opinion in Psychology, 17*, 55–60.

Tottenham, N., Hare, T. A., Quinn, B. T., McCarry, T. W., Nurse, M., Gilhooly, T., … Casey, B. J. (2010). Prolonged institutional rearing is associated with atypically large amygdala volume and difficulties in emotion regulation. *Developmental Science, 13*(1), 46–61. https://doi.org/10.1111/j.1467-7687.2009.00852.x

Tracey, I., Ploghaus, A., Gati, J. S., Clare, S., Smith, S., Menon, R. S., & Matthews, P. M. (2002). Imaging attentional modulation of pain in the periaqueductal gray in humans. *Journal of Neuroscience, 22*(7), 2748–2752.

van den Heuvel, M. I., Turk, E., Manning, J. H., Hect, J., Hernandez-Andrade, E., Hassan, S. S., … Thomason, M. E. (2018). Hubs in the human fetal brain network. *Developmental Cognitive Neuroscience, 30*, 108–115. https://doi.org/10.1016/j.dcn.2018.02.001

Valiente, C., Lemery-Chalfant, K., Swanson, J., & Reiser, M. (2008). Prediction of children's academic competence from their effortful control, relationships, and classroom participation. *Journal of Educational Psychology, 100*(1), 67–77. https://doi.org/10.1037/0022-0663.100.1.67

Whalen, P. J. (2004). Human amygdala responsivity to masked fearful eye whites. *Science, 306*(5704), 2061–2061. https://doi.org/10.1126/science.1103617

Zelazo, P. D. (2004). The development of conscious control in childhood. *Trends in Cognitive Sciences, 8*(1), 12–17. https://doi.org/10.1016/j.tics.2003.11.001

Zimmermann, P., & Iwanski, A. (2014). Emotion regulation from early adolescence to emerging adulthood and middle adulthood: Age differences, gender differences, and emotion-specific developmental variations. *International Journal of Behavioral Development, 38*(2), 182–194.

Facial Expressions Across the Life Span

Linda A. Camras

Abstract

The topic of facial expressions occupies a central role in theory and research on emotion and emotional development. This chapter reviews studies of emotional facial expressions in infants, children, and adults conducted largely in the twenty-first century. Two themes emerge from this literature review. First, early theories of emotional facial expression proposed toward the end of the twentieth century require substantial modification. Second, multimodal coding systems for emotion are more desirable than coding systems that rely solely on facial expression. Directions for significant future research are highlighted.

Facial Expressions Across the Lifespan

From both a historical and contemporary perspective, the topic of facial expressions occupies a central role in the study of emotion. In his seminal volume, *The Expression of Emotion in Man and Animals*, Darwin (1872/1998) described a number of facial expressions that he proposed were universally linked to human emotions and argued that these provided evidence for a common evolutionary ancestry among races and cultures. Nevertheless, initial research provided little supporting evidence for this position as several studies conducted during the mid-twentieth century purported to find no relationship between spontaneously produced facial expressions and emotion (see Ekman, Friesen, and Ellsworth, 1982, for both a review and critique of this research). For this and other reasons, by the early 1960s, emotion came to be viewed largely as an epiphenomenon, culminating in the cognitively oriented Schachter-Singer theory (Schachter & Singer, 1962) that was widely disseminated in numerous psychology textbooks. According to this theory, emotion was not an entity with independent ontological status but instead was merely a particular set of cognitions attributed to a state of physiological arousal experienced in the context of "emotion"-related situational cues.

Despite the dominance of this perspective, in the middle- and late-1960s, other researchers began to revive the Darwinian view through a set of studies on the recognition of prototypic emotional facial expressions similar to those described by Darwin (Ekman, Sorenson, & Friesen, 1969; Izard, 1971). This research culminated in a landmark investigation by Ekman and Friesen (1971) that reported significant levels of recognition in a preliterate New Guinea culture. Consistent with then-current views of neurobiology, Ekman (1972) proposed that prototypic facial expressions

L. A. Camras (✉)
Depaul University, Chicago, IL, USA
e-mail: lcamras@depaul.edu

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_5

for six "basic" emotions (happiness, surprise, anger, sadness, fear, and disgust) were linked to biologically based "affect programs" in the brain that automatically generated the corresponding facial expressions when the program was activated. However, in recognition of anthropological studies describing cultural differences in observed expressive behavior, Ekman's neurocultural theory acknowledged that this automatic expressive output could be overridden (e.g., suppressed, minimized, masked, or even amplified) in accordance with culturally derived "display rules."

Ekman's research launched a new era of emotion theorizing and research. Much of this research involves the continuing study of expression recognition by persons of different ages, cultural backgrounds, and other environmental circumstances. As will be seen in both this chapter and others in this volume, such research continues to this day. In fact, a PsycINFO search on "facial expressions" and "infants" or "children" that spanned the years between 2000 and 2017 yielded over 1600 citations of which approximately 1400 were studies of expression recognition.

However, at the same time, new questions are being raised regarding the relationship between facial expressions and emotion both in the adult literature and developmental studies (Fernandez-Dols, 2013; Fernandez-Dols & Russell, 2017). In the adult literature, new theories of emotion itself are being proposed based on more recent views of human neurobiology (Barrett, 2017; Clark-Polner, Wager, Satpute, & Barrett, 2016; Cunningham, Dunfield, & Stillman, 2013; Lindquist, 2013). In the same vein, studies of spontaneous expression production (as opposed to recognition of predetermined expression prototypes) are questioning the assumption of an automatic linkage between expression and emotion (Fernandez-Dols & Crivelli, 2013; Reisenzein, Studtmann, & Horstmann, 2013). These adult-oriented theories and studies have important implications for our understanding of development and for developmentalists' research agendas. This chapter will briefly review this recent scholarship in the adult literature as well as studies that have focused on infants, children, and adults at older ages. As will be seen, most research has focused on expressions for the six basic emotions investigated by Ekman and his colleague. However, we also will briefly touch upon several other emotions that have received attention in the literature. The chapter will conclude with a discussion that considers the implication of current findings for future developmental research and theory.

Infancy

Because infants are unable to verbally report on their feelings, developmentalists have been particularly interested in the possibility that their facial expressions might serve as a reliable indication of their emotional experience. Indeed, one prominent theory originally promulgated in the latter part of the twentieth century (i.e., differential emotions theory [DET]; Izard, 1971, 1991) proposed that discrete emotions (e.g., joy, surprise, anger, fear, sadness, disgust) emerged in infancy according to a maturational timetable and each emotion was invariantly linked to a particular emotional facial expression (see Izard & Malatesta, 1987, for details). To aid in his own and others' research, Izard and his colleagues developed the MAX and AFFEX coding systems (Izard, 1995; Izard, Dougherty, & Hembree, 1983) that described the facial appearance changes corresponding to each emotional expression. However, as noted above, more recent research has raised questions regarding the invariant linkage between emotions and facial expressions, and a more complex picture of expressive development has emerged.

Technological advances in 4-D ultrasound imaging have enabled researchers to observe facial behavior even in unborn fetuses. While few studies have been conducted as yet, research has revealed that fetuses produce a variety of facial expressions including smiles as well as expressions that would be coded as indicating physical distress/pain according to MAX and AFFEX (Reissland, Francis, & Mason, 2011). Such "pain" expressions can be observed in the

fetus during non-painful ultrasound procedures (Dondi et al. 2014; Reissland, Francis, & Mason, 2013), suggesting that they are not yet invariably tied to negative emotion as would be originally predicted by DET.

Instead, the findings for prenatal facial expressions align with a dynamical systems view of emotional development similar to the view of infant motor development pioneered by Thelen and her colleagues (Thelen, Kelso, & Fogel, 1987). According to this view (see Camras, 2011, for details), emotion involves a set of components (e.g., subjective experiences, facial expressions, physiological responses, instrumental behaviors) that develop independently with different developmental trajectories. These components may come together via a process of self-organization that is itself context-dependent. Thus, facial expressions may occur in some emotion episodes but not others. That is, an invariant link between facial expressions and other emotion components would not be expected.

In newborn infants, evidence for the independence of facial expression and emotion can also be seen. As is well known, neonatal smiles occur in several circumstances where positive emotion is unlikely to be present (e.g., during REM sleep, Emde & Koenig, 1969; Messinger et al., 2002). Based in part on such research, even Izard came to acknowledge that an invariant relationship between facial expressions and discrete emotions may not exist in neonates (Izard, 1997).

Regarding postneonatal infants, starting with the advent of social smiling during the second month of life (Messinger, 2008), infant smiling has not been reported in circumstances in which positive emotion is implausible or unlikely. Similarly, infants show a variety of negative facial expressions (often associated with crying) in circumstances during which negative emotion would be expected to be experienced (e.g., still-face studies, medical inoculations; Camras, 1992; Kohut et al., 2012; Oster, 2005). These valence-consistent observations align with a view of emotional development that preceded the promulgation of differential emotions theory and is still held by some contemporary scholars, i.e., a differentiation (and integration) perspective. Several versions of this approach have been proposed starting with Bridges (1930, 1932) and more recently followed by Camras (2011). These approaches share the view that young infants first experience relatively undifferentiated states of negative vs. positive affect and only later experience more discrete positive and negative emotions (e.g., joy vs. pride, anger vs. fear). Differentiation theories differ in terms of the mechanisms proposed to underlie developmental transitions (e.g., top-down generated maturational processes vs. bottom-up processes of self-organization). However, all differentiation theories stand in strong contrast to DET's proposal that infants initially experience discrete emotions rather than broader valence-based affective states.

At the same time, some researchers have added a layer of complexity to the valence-oriented view of emotional facial expressions in early infancy. Focusing on positive emotion, these researchers have examined morphological variations of infant smiles during various forms of social interaction and interpreted the different smile expressions as reflecting significant differences in infant emotional experience (e.g., Fogel, Nelson-Goens, Hsu, & Shapiro, 2000; Messinger, Fogel, & Dickson, 2001; Messinger, Mattson, Mahoor, & Cohn, 2012). Of importance, rather than interpreting these variations in terms of discrete emotion theory, these researchers espouse a dynamical systems view in which emotions are considered to be self-organized patterns of responses (including facial expressions) that emerge during a person's interactions with the environment. For example, open-mouth and closed-mouth smiles are linked to different types of social interaction (i.e., active vs. calm engagement with a social partner) and are considered to represent different forms of positive emotion. Thus various forms of expression may occur that are not tied to a narrow predetermined set of discrete emotion systems (see Messinger et al., Chap. 10 in this volume for a more detailed discussion of the relationship between smiles and positive emotion).

Also consistent with a dynamical systems perspective are findings that older infants (as well as neonates) sometimes produce emotional facial expressions when the corresponding emotion can be presumed to be absent. For example, Camras, Lambrecht, and Michel (1996) showed that MAX/AFFEX expressions of surprise (itself considered a "neutral" emotion) often occur when infants bring a familiar (and thus presumably non-surprising) object to their mouths. At the same time, infants presented with expectancy-violating events (e.g., an inexplicably vanishing object) do not typically show prototypic surprise expressions although they show nonfacial indications of surprise (i.e., behavioral stilling) and are judged by observers to be experiencing that emotion (Camras et al., 2002). Thus infant facial expressions may (or may not) occur independent from other components of the emotion process. As will be seen below, similar findings have been found in recent studies of adults.

Because the MAX and AFFEX systems specify expressions for several discrete negative emotions (e.g., anger, sadness, disgust, fear) but only one positive emotion (joy), much of the research intended to evaluate DET's proposals has focused on the expressions for negative emotions. Some early studies of postneonatal infants indeed appeared consistent with the idea of an invariant correspondence between expression and innate emotion programs in postneonatal infants. For example, in one early study, 2–19-month-old infants were found to show the predicted facial expressions of physical distress/pain and anger in situations during which these emotions might be predicted to occur (e.g., medical inoculations; Izard, Hembree, Dougherty, & Spizzirri, 1983). However, further research cast doubt upon the strength of this evidence (e.g., Izard et al., 1995; Oster, Hegley, & Nagel, 1992). In studies that coded infants' spontaneous facial expressions in a wider range of situational circumstances judged to elicit discrete emotions, the predicted matching between facial expression and emotions was not found. This was especially true for the negative emotions. For example, in a naturalistic study of her daughter's facial expressions during routine caregiving activities in her first 5 weeks of life, Camras (1992) observed considerable overlap in the situations that elicited MAX/AFFEX-specified discomfort/pain, anger, and sadness expressions. Furthermore, all three expressions tended to be produced together during bouts of crying. Camras interpreted these expressions as representing different intensities of undifferentiated negative affect (i.e., "distress") rather than three discrete negative emotions.

In another significant investigation, Hiatt, Campos, and Emde (1979) studied 10–12-month-old infants' facial responses to laboratory procedures designed (and judged by observers) to elicit happiness, surprise, and fear. Of particular importance, these investigators introduced inter-situational specificity and intra-situational specificity as the ideal criteria to be used to establish the status of a facial configuration as the expression of a discrete emotion. Inter-situational specificity is demonstrated if the presumptive emotional expression is shown significantly more often in a situation evoking its presumed emotion in comparison to situations evoking other emotions. Intra-situational specificity is demonstrated if the presumptive emotional expression is shown significantly more often in a situation evoking the target emotion in comparison to other emotional expressions produced in the same situation. In Hiatt et al.'s study, both criteria were met for happiness expressions, one criterion (intra-situational specificity) was met for surprise, and neither criterion was met for fear.

In a later investigation, Camras et al. (2007) studied 11-month-old Japanese, Chinese, and European American infants in situations designed (and judged by observers) to evoke anger/frustration and fear. They found that MAX-specified anger expressions were produced more often than other emotional expressions in both the anger/frustration and fear situations. Max-specified fear expressions were produced less often in both situations. Thus, intra-situational specificity (but not inter-situational specificity) was found for the anger expression, while neither inter-situational specificity nor intra-situational specificity was demonstrated for fear. Lack of

specificity for negative emotional expressions was also found for 4-month-old infants by Bennett, Bendersky, and Lewis (2002) whose study included a wider range of negative emotions. These researchers also subsequently investigated the possibility that emotional expression becomes more differentiated later during infancy. In a study of both 4-month-old and 12-month old infants (Bennett, Bendersky, & Lewis, 2005), they obtained some evidence that negative expressions differentiate (i.e., selectively correspond to one particular discrete emotion) to some extent during the second year. However, such differentiation was far from complete.

In a research program focusing on MAX-specified anger and sadness expressions, Michael Lewis and his colleagues have examined responses produced by infants in variations of a contingency learning procedure (see Lewis, 2014). One particular focus of this research has been the study of associations between the MAX-specified anger and sadness expressions and infants' active attempts to produce a desirable outcome (i.e., turning a mobile). While the associations are not completely consistent, in many variations of this paradigm, when infants show the MAX-specified anger expression, they engage in more vigorous attempts to activate the mobile than when they show the MAX-specified sadness expression. These results are consistent with those obtained by Camras, Sullivan, and Michel (1993) who found the body activity of an infant showing the MAX-specified expressions of pain/discomfort or anger to be more vigorous than her body activity accompanying the sadness expression. Lewis and his colleagues (Lewis & Ramsay, 2005; Lewis, Ramsay, & Sullivan, 2006) have also found that sadness expressions are related to increases in cortisol responding as well as lesser body activity in their contingency-learning paradigm. However, Lewis (2014) currently does not conclude that the MAX-specified anger and sadness expressions represent two different discrete emotions. Instead, he sees them as reflecting broad behavioral tendencies toward approach vs. withdrawal that provide the foundation for (but are not entirely equivalent to) the adult-like discrete emotions of anger and sadness.

After the first year, new emotions (e.g., shame and embarrassment; Lewis, 2014; Izard & Malatesta, 1987) are thought to emerge. These more complex emotions are often referred to as "self-conscious" or "social" because they require the ability to distinguish between the "self" and other persons and because they are elicited primarily by social stimuli (e.g., being gazed upon by a stranger; failing to meet others' expectations). Interestingly, prototypic expressions described for these social emotions are not distinguished by facial behaviors alone but instead are expressed via a combination of facial movements, body posture, and gaze direction (e.g., a slight smile accompanying gaze aversion for embarrassment). Interestingly, pride (an emotion that has been studied in older children and adults although not in infants) also is expressed via a combination of facial expression and body posture (e.g., smile plus raised arms and expanded chest; Tracy & Robbins, 2004).

Taken as a whole, one practical implication of these findings is that interpreting infant's facial expressions in terms of valence (i.e., positive vs. negative) may often be more appropriate than attributing discrete emotions to infants based solely on their facial expressions. This may be particularly appropriate in situations where an emotion attribution is plausible, but there is no nonfacial evidence for a specific discrete emotion. In line with this view, many current studies of infant emotion take an approach more consistent with a valence-based view of infant expressive behavior. For example, many studies using the still face procedure to investigate mother-infant interactions categorize infant responses as positive vs. negative (e.g., distress rather than anger or sadness) and do so on the basis of the infant's vocalizations (e.g., fussing or crying) as well as their facial behavior (e.g., Haltigan, Leerkes, Supple, & Calkins, 2014; Tarabulsy et al. 2003).

Other still face investigations utilize the behavioral category system developed by Tronick, Als, and Brazelton (1980) that involves affect-laden functional categories (e.g., positive social engagement, protest) rather than discrete emotions (e.g., Moore & Calkins, 2004). Studies of unmodified face-to-face interactions between infants and

adults (e.g., mothers, strangers) also often categorize infant affect as positive vs. negative utilizing both facial and nonfacial behaviors (e.g., Colonnesi, Zijlstra, van der Zande, & Bogels, 2012; Lin & Green, 2009; Yale, Messinger, Cobo-Lewis, & Delgado, 2003). Investigations of other topics have taken this valence-oriented approach as well (e.g., Whitney & Green, 2011, in their study of infant affect following the onset of self-produced locomotion) or are at least consistent with such a view (e.g., Parlade et al., 2009, in their study of anticipatory smiling).

In summary, current research suggests that links between infant facial expressions and other components of emotion do not appear to be invariant. At the present time, it seems more prudent to take the position that no single component of emotion can stand alone as a context-free measure of discrete emotions in infancy. Facial expressions themselves may more reliably indicate positive vs. negative emotion. However, when such expressions are combined with other cues (e.g., withdrawal from a stimulus designed to induce fear), it may be appropriate to infer the presence of a discrete emotion (e.g., fear) based on the combination of cues. Still, expressions may sometimes be produced when emotion is not experienced (e.g., neonatal smiles and surprise expressions) and sometimes may not be produced when other indicators of the emotion occur (e.g., surprise in response to an unexpected event). Therefore, researchers should be encouraged to utilize multiple indicators as well as contextual cues when assessing emotion in infants. As will be seen below, this conclusion is held by many to apply to emotions throughout the life span.

Socialization Influences and Individual Differences

As noted above, one important rationale for early studies of infant facial expressions was the assumption that infants are not subject to cultural display rules, and thus their expressive behavior is a true reflection of their affective experience. Still, some contemporary scholars have explored possible cultural differences in infant expressive behavior presumed to reflect socialization influences. In addition, potential socialization mechanisms leading to cultural and/or individual differences in expressive behavior (e.g., adult modeling and infant imitation) have been studied in samples of Western (i.e., European and American) infants.

Some researchers have proposed that neonatal imitation of adult facial behavior provides the foundation for social cognitive development (Meltzoff, 2005). However, after 40 years of research, the phenomenon of neonatal imitation itself remains controversial especially with respect to the imitation of emotional facial expressions (Oostenbroek, Slaughter, Nielsen, & Suddendorf, 2013). Still, even if infants' imitative capacities do not develop until later, imitation might play an important role in the development of their expressive behavior. For example, Holodynski and Friedlmeier (2006) have proposed that caregivers may respond to infants' undifferentiated negative expressions (e.g., crying) by themselves displaying the more specific discrete expression corresponding to the emotion they believe the infant to be experiencing (e.g., anger or sadness). Thus, caregivers may "teach" the infant how to facially express discrete emotions. In a similar vein, Cole and Moore (2015) have proposed that adults may respond to infant facial "babbling" with behaviors that help organize their emotional experience. However, while the proposed role of mutual facial imitation is appealing, current evidence is mixed.

Malatesta and her colleagues (Malatesta, Grigoryev, Lamb, Albin, & Culver, 1986; Malatesta & Halviland, 1982) found evidence for American mothers' imitation of infant emotional expressions in studies of face-to-face interactions. However, in a study of American, Kenyan, and Fijian mothers and their 7-month-old infants, Broesch, Rochat, Olah, Broesch, and Henrich (2016) found that the frequency of affectively mirrored responses by mothers was low in general, and more American mothers did so than Kenyan or Fijian mothers. For example, while 62% of American mothers engaged in at least some degree of affect mirroring, only 38% of

Kenyan mothers engaged in any affect mirroring at all.

Regarding infant imitation of emotional expressions, in an early study, Haviland and Lelwica (1987) found limited evidence for 10-week-old infants' imitation of joy and anger expressions posed by their mothers, but infants responded to sad expressions with nonspecific mouthing rather than sad expressions of their own. More recently, in a study that presented infants with a virtual character that modeled expressions of discrete emotions, Soussignan et al. (2018) found that 3–12-month-old infants tended to respond with valence-congruent expressions (i.e., positive or negative) rather than more precise matches to the model's specific discrete emotional expression. However, some evidence for differential mimicry of anger versus fear expressions by 7-month-old infants has been obtained in a single study using electromyographic (i.e., EMG) measures of facial muscle movements (Kaiser, Crespo-Llado, Turati & Geangu, 2017). Electromyography potentially can measure low-intensity facial expressions that are not observable to the naked eye (see further discussion of mimicry below).Thus, future research is necessary to determine the extent to which adults model and imitate emotional facial expressions for infants in different cultures and the role this plays in the development of infants' own facial expressions.

Aside from focusing on the development of qualitatively differentiated (i.e., morphologically different) facial expressions for different emotions, other studies have investigated quantitative differences, i.e., greater or lesser amounts of emotional expressivity. Research on individual differences in infant emotional expressivity is closely tied to the extensive literature on infant temperament. Indeed the most commonly used measures of temperament (i.e., the LAB-TAB [Goldsmith & Rothbart, 1993] and Infant Behavior Questionnaires [Gartstein & Rothbart, 2003]) rely on objective coding of infant emotional responding to laboratory procedures or caregiver ratings of infant emotional responses to naturally occurring events encountered in daily life (e.g., introduction to a stranger). Consistent with the approach advocated above, these measures do not rely exclusively on facial behavior in their assessment of infants' and children's emotion responding. However, the individual differences in temperament revealed by these measures directly reflect individual differences in emotional expressivity that include production of facial expressions.

Cultural differences in infant emotional expressivity have also been found due to differing norms and values related to parental behavior. For example, Wormann, Holodynski, Kartner, and Keller (2012) observed significant differences between German and Nso infants from Cameroon in their frequency of smiling. While social smiling emerges by 6 weeks of age in both cultures, 3-month-old German infants proceed to smile substantially more often than do Nso infants. This difference in infant smiling corresponds to differences between mothers in the two cultures in their own smiling behavior. The researchers attribute their findings to cultural differences in the value placed on smiling (see also Keller, 2017). Similarly, Camras et al. (1998) found differences in overall facial expressivity between American, Japanese, and Chinese infants in an earlier study. Consistent with Wormann et al., these investigators suggest that their findings may be due to cultural differences in both parenting behaviors and the value placed on emotional expressivity. In particular, Western cultures are thought to value emotional expressivity more than Asian cultures although differences among Asian cultures may also exist (Chen, 2000; Wu, 1996).

In summary, the influence of adult modeling on the development of infant facial expressions for discrete negative emotions remains uncertain. However, future studies might produce further evidence for this and other socialization influences (e.g., selective reinforcement of infants' discrete emotional expressions by adults). In contrast, evidence for cultural (and thus presumably socialization) influences on infants' level of facial expressivity is more consistent although relatively few studies have been conducted on this topic.

Toddlers and Children

Expression Differentiation

Few studies of toddlers and older children have focused specifically on the question of whether children's emotional facial expressions are selectively associated with specific discrete emotions. However, those studies that exist have failed to provide evidence for strong differentiation of negative facial expressions (i.e., differentiated relations between discrete negative emotions and their presumed corresponding prototypic facial expressions). For example, Castro, Camras, Halberstadt, and Shuster (2017) examined facial expressions produced by 7–9-year-old children during the course of conversations with their mothers about some topic on which they disagreed (e.g., bedtime, homework). Subsequently, children viewed the videotapes of their interaction with their mother and reported their own emotional experience at various points during the interaction. Similarly, naïve observers viewed the videotapes and reported the emotions they judged to be expressed by the children. Lastly, the children's facial expressions were objectively coded and assigned emotion scores based on the MAX/AFFEX coding systems and Ekman, Friesen, and Hager's (2002) Facial Action Coding System (FACS). Results showed that the naïve observers were able to discern the children's self-reported emotions with significant accuracy. Furthermore, applying the criteria of inter-situational specificity and intra-situational specificity to the objective facial coding, they found significant correspondence between joy expressions and children's self-reports of joy. However, no significant correspondence between specific negative emotions (i.e., anger, sadness, fear) and their predicted corresponding facial expressions was obtained.

In an innovative study (described in Castro et al., 2017), Shuster coded facial expressions of children engaged in a fear-producing Internet prank commonly referred to as the "Scary Maze." For this prank, the child is engaging in a computerized maze game when the maze suddenly transforms into the screaming face of the demon-possessed girl in the movie "The Exorcist." Hundreds of YouTube videos have been posted showing children's responses to this semi-standardized procedure. Shuster identified 60 videos of children who appeared to be 4–10 years of age and analyzed them using a strategy similar to that employed in Castro et al.'s 2017 study. Naive raters viewed the tapes and rated the children as experiencing fear more than any other negative emotion (although surprise was rated even higher than fear). The children's facial expressions were then objectively coded and assigned emotion scores based on MAX/AFFEX and FACS. Results showed that fear expressions (or components thereof) were produced more often than expressions for any other negative emotion. However, less than half the children produced the prototypic fear expression.

Mixed results have also been found in other studies. For example, Gaspar and Esteves (2012) observed 3-year-old children in a preschool setting. With the exception of joy, they found no significant relationships between the children's facial expressions and the emotional contexts in which they were being observed. Underwood and Bjornstad (2001) obtained self-reports of 8-, 10-, and 12-year-old children's emotional responses to losing a computer game and being taunted by their opponent. They found that anger facial expressions were significantly correlated with self-reports of feeling sad and bothered by their opponent's teasing rather than with self-reports of anger itself. In contrast, angry verbalizations produced during the game were indeed correlated with self-reports of anger.

Galati, Miceli, and Sini (2001) MAX-coded the facial expressions of a small number of congenitally blind and also sighted children in seven laboratory procedures designed to elicit anger/frustration, joy, surprise, interest, anger, fear, disgust, or sadness. They also obtained observer judgments of the emotions being expressed by the children. Data analyses showed significant correlations between the objectively coded facial movements produced by the blind and sighted children within each of the several emotion-eliciting situations. However, few associations were found between the naïve coders' emotion judgments and children's

production of the specific facial movements corresponding to the judged emotions as designated within the MAX system. Finally, in a study focusing on anger, Hubbard et al. (2004) examined relations among behavioral (facial and nonfacial), physiological, and self-report measures of anger in second-grade children during a game involving a confederate who cheated but won the game. While significant correlations were found between facial expressions and the other anger indices, the modest magnitude of these relations led these researchers to conclude that using multiple measures was a more desirable approach to studying children's anger.

Consistent with this recommendation, in a research program focusing on toddlers' and children's fear and its regulation, Buss and her colleagues have utilized composite fear scores based on both fear facial expressions and nonfacial behaviors (e.g., freezing, cessation of play, body tension, and trembling). These studies have produced a number of findings that have importantly contributed to the understanding of the development of maladaptive fear. To illustrate, Buss (2011) found that 2-year-old children who showed high levels of fear in low-threat situations were reported by their parents and teachers to show more anxiety in kindergarten than children who earlier had shown lower levels of fear. In another recent study, Brooker, Kiel, and Buss (2016) reported that higher levels of social fears combined with high levels of inhibitory control in 2-year-old children predicted higher levels of socially anxious behaviors at 5 years of age.

Multimodal coding strategies have also been used in other studies of children's emotion. For example, Dennis, Cole, Wiggins, Cohen, and Zalewski (2009) coded anger, sadness, and happiness expressed by children during two "challenging" tasks commonly used in research with preschool children (a boring wait task and a locked box that cannot be opened). Rather than relying solely on facial cues, these investigators included vocal and postural cues in their emotion coding system. This study is noteworthy as one of the few investigations that has focused on relations between expressive behavior and functional actions that might be theoretically predicted to be differentially associated with each of the three emotions. Results were consistent with the authors' predictions that anger and happiness expressions would be associated more often than sadness expressions with attempts to respond effectively to the tasks' demands.

In a naturalistic study involving home observations of 8–12-year-old children, Sears, Repetti, Reynolds, and Sperling (2014) utilized facial, vocal, and physical behaviors (including aggressive behaviors) to identify anger episodes in order to characterize the contexts in which anger occurred. The authors interpreted their findings within a functionalist framework, concluding that angry behaviors appeared to be attempts by the children to achieve their goals (e.g., throwing a pencil to get out of doing homework). In another study focusing on anger, anger regulation and language skills in in 1/2–4-year-old children, Roben, Cole, and Armstrong (2013) included both facial and vocal cues in their coding system for anger expressed during a "boring wait" procedure. Greater language skills were associated with lower anger expression over time, and this relationship was partially explained by children's use of distraction and support-seeking from their mother as anger regulation strategies. In summary, multimodal coding strategies for emotion have produced a number of interesting and important findings, illustrating their value for studying many aspects of children's emotional development.

Expression Regulation

Emotion regulation has been a topic of great concern among developmental researchers and expressive regulation constitutes a sub-type of this larger category. Expression regulation has been most commonly studied in a widely used paradigm developed by Carolyn Saarni (1984) commonly known as the "disappointing present" procedure. In the context of this procedure, children are given an undesirable present (e.g., a baby rattle, a broken pair of sunglasses), and their overtly expressed positive and/or negative

responses are examined. Numerous variations of this procedure have been investigated, and (following Saarni's original approach) most utilize multimodal coding systems to assess children's expression of positive vs. negative emotion. Still, results from these studies most likely reflect children's facial as well as verbal and bodily behavior.

Starting at a young age, children begin to be capable of regulating their expressive behavior although they may not always do so. For example, 3–9-year-old children were found to modify their expressive response to the disappointing present when in the presence of the adult gift-giver (Cole, 1986). Despite their disappointment, children of both sexes smiled more when given the undesirable gift than they did in a "neutral emotion" condition (i.e., while looking at pictures) with girls smiling even more than boys. In addition, children have been found to smile more when receiving the present in the presence of an adult, while in private they express more negative emotion (Cole, Zahn-Waxler, & Smith, 1994). The ability to regulate overt expressivity improves throughout childhood (Kromm, Farber, & Holodyski, 2015) and is related to children's understanding of how to differentiate between emotion and expression. When asked to articulate possible reasons for regulating their expressive behavior, school-age children are able to provide a number of plausible rationales that include avoiding hurting others' feelings and avoiding negative consequences for self (Saarni, 1979).

While expressive regulation is often operationalized in a task that involves expression suppression, by definition it can involve other forms of regulation including selectivity in where one directs their expressive behavior. This is exemplified in a study by Buss and Kiel (2004) in which facial expressions of 24-month-old infants were coded during experimental procedures commonly used to elicit anger/frustration or fear. Taking advantage of their mothers' presence, the toddlers directed their AFFEX-specified "sadness" expressions toward their mothers more often than "anger" or "fear" expressions but did not differentiate among these expressions when looking at the frustrating stimulus. These authors proposed that the sadness expressions may be deliberate bids for aid and comfort rather than automatic expressions inherently linked to experienced emotion.

In a particularly novel proposal, Holodynski has asserted that emotional expression may also be used to regulate one's own behavior. Holodynski (2004) has sought to demonstrate this in a study that compared 6-, 7-, and 8-year-old children's expressions of joy as well as disappointment in both a social (experimenter present) and nonsocial (experimenter absent) condition. Expressive intensity was assessed via observers' ratings of the children's postures and gestures as well as their facial expressions and was summed across both positive and negative expressions. The children also rated their own emotional responses in both conditions. Results showed that children's expressive intensity decreased with age in the nonsocial condition although the intensity of their self-reported emotion did not. In contrast, neither expressive intensity nor self-reported emotional intensity decreased with age in the social condition.

Holodynski interpreted these findings as consistent with an internalization model of emotional development (Holodynski & Friedlmeier, 2006). Similar to Vygotsky's internalization model of language, Holodynski and Friedlmeier's model proposes that emotional expression emerges in the context of social interaction (e.g., between parent and infant) and overtly observable expressions initially function to regulate both social interaction and the child's own nonsocial behavior (similar to Vygotsky's private speech). However, over time, emotional expression is internalized in self-regulatory situations although it continues to be manifested overtly in social situations where it continues to serve its social regulatory function. This intriguing theory is consistent with several studies (reviewed by Wagner & Lee, 1999) showing that positive expression (i.e., smiling) is often enhanced within a social environment. However, other research (also reviewed in Wagner & Lee, 1999) has shown that some negative emotional expressions (e.g., crying) may be overtly shown more often in nonsocial situations and thus may serve a self-

regulatory function. Therefore, the developmental course of emotional facial expressions throughout childhood requires further investigation that attends more closely to similarities and differences among different emotions and among children from different family backgrounds and cultures. In particular, the role of socialization influences that may differ across cultures must be considered.

Socialization Influences

Developmental researchers focusing on American and European children have devoted considerable attention to emotion socialization during childhood including socialization influences on emotional expressivity. At the same time, very few studies have focused specifically on children's facial expressions. Still, the theoretical models and research findings that have been obtained presumably can shed light on the development of facial expressions or at least provide the basis for further studies that focus specifically on facial behavior.

Two decades ago, Eisenberg, Cumberland, and Spinrad (1998) introduced a model of emotion socialization that is still highly regarded today. While the model focused on parental influences, it can be readily extended to include other socialization agents. Four categories of emotion-related socialization behaviors (ERSBs) were distinguished: (a) parents' own emotional expression (i.e., modeling), (b) reactions to the child's own expressive behavior (i.e., contingent responding), (c) discussions of emotion with or in the presence of the child, and (d) management of children's exposure to emotion-inducing situations. Much of the emotion socialization research conducted with children in recent years can be accommodated within this model (see Camras & Shuster, 2013; Camras, Shuster, & Fraumeni, 2014; Cole & Tan, 2007 for reviews). For example, in a meta-analytic study of the extant literature, Halberstadt and Eaton (2003) concluded that expressivity by family members was significantly related to children's own emotional expressiveness with effects being stronger for positive expression and somewhat weaker for negative expressivity. However, in these studies, emotions could be expressed by a variety of behaviors, including verbal, vocal, and gestural as well as facial behaviors.

In a study that focused specifically on facial expressions, Camras et al. (1990) found significant modeling effects in families with maltreated or nonmaltreated 3–7-year-old children. Mothers and children were videotaped during a laboratory play session and during home observations, and their facial behavior was objectively coded using anatomically based coding systems. Mothers' and children's expressions of surprise and happiness were positively related within both types of families.

As with infants, studies of children from different cultural groups can be particularly valuable as group differences are typically interpreted as deriving from socialization influences that may reflect cultural values. This reasoning is illustrated in study by Camras, Chen, Bakeman, Norris, and Cain (2006) who studied the facial behavior of European American, Chinese American, Mainland Chinese, and American-adopted Chinese children as they viewed slides showing positive and negative emotion stimuli (e.g., a bunny with sunglasses, a girl eating a worm). European American children were significantly more expressive than Mainland Chinese children, while the Chinese American children and adopted Chinese children fell between these two groups. Children's overall expressivity was positively correlated with mothers' self-reported positive expressivity and negatively correlated with mothers' identification with Chinese culture (which, as noted above, includes emotion control as an important value; Chen, 2000; Wu, 1996). In a study that utilized the disappointing present procedure, Garrett-Peters and Fox (2007) also found European American children to be more expressive (i.e., produce more positive responses) than Chinese American children. Both investigations are consistent with the above-presented proposal that maternal behavior often reflects cultural values and likewise influences children's expressive development.

Adulthood

Expression-Emotion Coherence

Much of the research on adult facial expressions has focused on the issue of "coherence" among components of emotion, particularly facial expression, self-reported emotion, and autonomic nervous system responses. Although otherwise named, this research generally corresponds to the study of expression "differentiation" that was reviewed above for infants and children. As indicated earlier, discrete emotion theories proposed during the latter part of the twentieth century predicted strong within-emotion coherence between specific facial expressions and other emotion components as they were all considered to be controlled by specific affect programs that differed for the different discrete emotions.

Consistent with the expectation of within-emotion coherence, several early studies indeed reported significant relations between a specific emotion and its corresponding facial expression. For example, Rosenberg and Ekman (1994) found that when a disgust expression was shown by participants observing a disgust-inducing video, 75% of the time the participant reported that disgust was experienced more strongly than any other negative emotion. Similarly, Mauss, Levenson, McCarter, Wilhelm, and Gross (2005) obtained strong correlations between self-reports of sadness by participants watching a sad video and ratings of their expressed sadness made by observers who used a rating system informed by descriptions of prototypic facial expressions. In a narrative review of these and other studies, Matsumoto, Keltner, Shiota, O'Sullivan, and Frank (2008) found generally moderate correlations between emotion-specific facial expressions and self-reports of emotion. However, in several cases, these same facial expressions were also significantly correlated with other self-reported emotions. For example, Ekman, Friesen, and Ancoli (1980) found that disgust expressions were significantly correlated with self-reported fear as well as disgust. However, fear expressions were so rarely produced that the investigators could not assess their correspondence to fear self-reports. In a study of bereaved adults, Bonanno and Keltner (1997) found that interviewer-reported symptoms of grief were correlated with anger and contempt facial expressions as strongly as with sadness facial expressions.

These investigations thus suggest that correspondence between spontaneous emotional facial expressions and emotion experience is limited. Indeed, this is the conclusion reached in a more recent review (Duran, Reisenzein, & Fernandez-Dols, 2017) that reported separate meta-analytic evaluations of six emotions (happiness, surprise, anger, fear, sadness, and disgust). Across the emotions, the average correlation was 0.35, and the average proportion of participants who showed the predicted expression was 0.23. Importantly, in the majority of these studies, participants were not aware of being observed and cultural display rules regarding public displays of emotion were unlikely to be operating. However, none of the studies conducted with adults utilized the criteria of inter-situational specificity and intra-situational specificity (as earlier described) to evaluate the differentiated coherence between prototypic emotional expressions and emotional experience. Still, based on the entire body of research on emotion coherence, even some investigators who found evidence for coherence in their own studies currently conclude that "there is no gold standard measure of emotional responding. Rather experiential, physiological, and behavioral measures are all relevant to understanding emotion and cannot be assumed to be interchangeable" (Mauss & Robinson, 2005, p. 209).

Older vs. Younger Adults

Possibly in response to popular stereotypes about aging, a number of investigations have compared younger and older adults to determine whether facial expressivity declines with age. Perhaps surprisingly, several early studies reported no differences for older and younger adults. For example, Levinson, Carstensen, Friesen, and Ekman (1991) used a relived emotion procedure in which participants were asked to describe a personally experienced episode of happiness,

surprise, anger, sadness, fear, and disgust. No significant differences were found between younger and older adults in the facial expressions they produced. Similar results were obtained by Tsai, Levenson, and Carstensen (2000) in a study of Chinese American and European American younger and older adults who viewed happy and sad film clips. In contrast, using a relived emotion procedure for the emotions of interest, sadness, fear, anger, and affection, Malatesta-Magai, Jonas, Shepard, and Culver (1992) reported that older adults were actually more expressive than younger adults. Taken together, these studies suggest that differences in expressivity between older and younger adults are context-dependent rather than all pervasive. In any case, evidence for an overall decline in facial expressivity has not been found.

Expression Regulation and Cultural Display Rules

Although expression regulation cannot completely account for the limited coherence found between emotional expression and other components of emotion, it remains a plausible explanation in some circumstances. In fact, in a study that directly manipulated expression regulation (Dan-Glauser & Gross, 2013), coherence indeed decreased in participants who were explicitly instructed to suppress their expressive behavior. Individuals may suppress (or otherwise modify) their expressive behavior for a number of reasons (e.g., to protect oneself by deceiving others). However, the operation of culturally based expressive display rules (i.e., social norms) is often invoked in the adult literature due to their role in the history of emotion theory. As noted above, virtually all contemporary theories of emotion acknowledge that spontaneous emotional expressions can be modified in accordance with cultural display rules that presumably are inculcated via socialization processes. Yet surprisingly little research has focused on identifying such "rules" as they may exist in either Western societies or non-Western cultures. Furthermore, while it seems clear that expressive norms are often tied to specific situations (e.g., European Americans find it rude to laugh at a funeral but not at a comedy show), such current studies that exist have tended to focus on overall cultural differences in emotional expressivity. Still, while these studies do not specifically target facial expressions as the means of emotion communication, they have provided some important methodological tools and empirical data that may serve as the basis for further research.

In the most systematic program of research in this area, Matsumoto, Yoo, Hirayama, and Petrova (2005) developed a questionnaire designed to measure norms regarding emotional expression in a variety of cultures (i.e., the Display Rule Assessment Inventory). In one impressively comprehensive study (Matsumoto et al. 2008), over 5000 university students from 32 countries were asked to select among six theoretically derived options for how one should express each of seven emotions (anger, contempt, disgust, fear, happiness, sadness, and surprise) in either public or private encounters with each of several different individuals (e.g., father, mother, older sister, younger brother, close female friend, younger fellow student, older female professor). The response options corresponded to those originally described by Ekman and Friesen (1969): Show more emotion than you feel, express it as you feel it, show the emotion while smiling at the same time, show the emotion less than you feel it, hide your feelings by smiling and show nothing at all. These categorically distinct options were statistically converted to a continuous scale to represent overall expressivity. Among the complex set of findings, results indicated that members of individualistic cultures endorsed greater expressivity than members of collectivistic cultures although this overall effect was driven mostly by the findings for happiness and surprise. Members of all cultures endorsed greater expressivity to in-group individuals (operationalized as close friends) than out-group members (operationalized as acquaintances). Members of individualistic cultures were more

expressive of some emotions (happiness, surprise) to both in-group and out-group members than were members of collectivistic cultures. However, members of individualistic cultures were less expressive of negative emotions to out-group individuals than were members of collectivistic cultures. These findings are consistent with a view of individualistic cultures as both valuing the freer expression of emotion and distinguishing less between in-group and out-group individuals than do collectivistic cultures in their expression of negative emotion.

Other studies of expression norms have been narrower in scope but have been largely consistent with Matsumoto et al.'s overall conclusions. For example, Tsai and her colleagues (Tsai, 2007; Tsai, Knutson & Fung, 2006) found that East Asians prefer low arousal forms of positive emotions (e.g., contentment), while European Americans prefer high arousal forms (e.g., excitement). Correspondingly, Tsai, Chentsova-Dutton, Freire-Bebeau, and Przymus (2002) found that Hmong Americans produced fewer social smiles than did European Americans in a relived emotion task during which they were interviewed by an experimenter. Importantly, the two groups did not differ in their self-reported level of positive emotion. While specific socialization mechanisms were not explored in this study, the researchers' implicit assumption was that socialization influences were responsible for these differences. Indeed, in other research, Tsai, Louie, Chen, and Uchida (2007) documented corresponding differences between Asian and American cultural artifacts (i.e., children's storybooks) that presumably serve to model appropriate emotional experience and behavior.

Expression Dialects

More recently, an intriguing line of research has focused on cultural differences in emotional facial expressions that are not attributable to norms regarding whether to show or hide an emotion. According to dialect theory (Elfenbein, 2017; Elfenbein, Beaupre, Levesque, & Hess, 2007), facial expressions of emotion may differ across cultures in their fine-grained details. To illustrate, Elfenbein et al. (2007) asked participants from two different cultural groups (Quebecois-Canadians and Gabonese) to pose a set of emotional facial expressions that "their friends would be able to understand easily." The resulting expressions were coded using Ekman and Friesen's (1978) anatomically based facial action coding system (FACS). Results showed cultural differences in at least some of the facial muscles typically activated by participants. For example, Quebecois-Canadians more typically narrowed their eyes when posing anger, while Gabonese-Canadians more typically widened their eyes. Interestingly, the expressions posed by both sets of participants would be interpreted as variants of the anger expression according to the most recent version of FACS (Ekman, Friesen, & Hager, 2002). Still, when the posed expressions were shown to other members of each cultural group, an "in-group" advantage in emotion recognition emerged. That is, each group was able to recognize poses by members of their own culture better than those produced by members of the other cultures. These results are consistent with Elfenbein and Ambady's (2002) meta-analysis of 186 studies comparing expression recognition by in-group vs. out-group members that included several investigations of children as well as teenagers and adults (Elfenbein & Ambady, 2002). To explain the cultural differences found in both the posing and recognition of the posed emotional expressions, Elfenbein and her colleagues (e.g., Elfenbein 2017) have speculated that processes similar to those that create linguistic dialects (e.g., random drift and social stratification) may be operating.

Mimicry

A substantial number of adult studies involve showing participants' stimuli depicting emotional facial expressions to assess spontaneous imitation of facial expressions (termed "mimicry" in the adult literature). Research on facial mimicry was originally undertaken to investigate the proposal that such mimicry was automatic and mediated

emotion recognition, emotion contagion, and/or empathy (see Hatfield, Caccioppo, & Rapson, 1994). Adult mimicry studies most often measure electromyographic (EMG) responses that allow for the assessment of potentially unobservable facial reactions (due to low-intensity muscle contractions, as noted in the earlier discussion of infant imitation). However, because only two muscles (zygomaticus and corrugator) are typically measured, discriminating among different negative emotional expressions usually is not possible. Still, recent research suggests that mimicry may indeed contribute to the recognition process, but that mimicry does not always occur (e.g., van der Schalk et al., 2011). According to one particularly interesting proposal (Neidenthal, Wood, Rychlowska, & Korb, 2017), mimicry is facilitated by eye contact with the expresser which itself may or may not take place depending on social contextual factors (e.g., the relationship between expresser and perceiver). To date, only a few developmental studies on spontaneous facial mimicry have been conducted with toddlers and children (e.g., Geangu, Quadrelli, Conte, Croci, & Turati, 2016), making this a potentially fruitful area for future research bridging the gap between studies of infant and adult expressive imitation.

Conclusion

Two themes have emerged in this chapter's review of the literature on facial expressions at various points in the life span. First, views of facial expressions that were proposed roughly 50 years ago based on earlier work by Darwin require substantial modification. In particular, emotional facial expressions can no longer be considered as automatic outputs of separate emotion-specific programs in the brain or even as obligatory components of discrete emotion "networks." At the same time, facial expressions are clearly not completely irrelevant to emotion. Thus, identifying the factors that determine whether a prototypic facial expression is or is not produced presents an important challenge to researchers attempting to better understand both the nature of facial expressions and of emotion itself. Expression modification in the service of cultural norms or even personal propensities most certainly play a role. However, this is not the whole story. While new alternative developmental theories of emotional expression can be proposed at this time (e.g., Camras, 2011), a truly viable theory requires a more extensive body of data upon which it can be based. Acquiring such data via innovative studies of expression production in a variety of naturalistic as well as laboratory settings is thus necessary. At the present time, barriers to acquiring such data are substantial given the labor-intensive nature of studies in which facial expressions are objectively coded rather than subjectively judged by observers. However, current technological advances in computerized facial coding (via programs such as FaceReader or CERT) show promise in reducing the burden by providing alternatives to manual coding in the future. Currently such programs are severely limited in their ability to accurately identify both prototypic and non-prototypic facial expressions in the range of situations that reflect real-life facial behavior (e.g., Yitzhak et al., 2017). Hopefully, further advances will lead to overcoming their current limitations.

A second important theme of this chapter is closely related to the first and involves the use of facial expressions as a measure in studies designed to principally investigate other aspects of emotion (e.g., emotion regulation). As argued above, if facial expressions are not invariant outputs of discrete emotion systems, they cannot stand alone as an investigator's sole measure of emotion. As also noted, in recent years, this position has been implicitly recognized in much of the developmental literature. That is, there has been an increasing tendency for infant researchers to interpret young infants' emotional expression in terms of valence rather than discrete emotions and for researchers investigating toddlers and older children to use multimodal measures of emotion. Using multimodal measures is particularly important for studies designed to investigate emotional responses that may not be considered appropriate for their situational context. This is because facial expressions can

sometimes be evoked by non-emotion stimuli (as illustrated in Camras et al., 1996, described above). Given that studying contextually inappropriate emotion responding is an important line of research that can contribute to our understanding of healthy emotional development, multimodal measures of emotion are of particular importance.

At a number of points in this chapter, specific gaps in our knowledge about the development of facial expressions have been noted. One reason for noting these gaps is to highlight particular opportunities for future research. For example, systematic studies of expressive differentiation in toddlers are lacking. Studies that address this issue using the important criteria of intra-situational specificity and inter-situational specificity would make a significant contribution to our understanding of expressive development. In addition, expressive dialects as described for adults have received little attention in the child development literature. However, as for adults, these dialect differences could potentially have important implications for communication in our increasingly multicultural society. Studies that more explicitly examine links between cultural display rules and actual expressive behavior in both adults and children would also be of value. A final suggestion is that further research on expressive imitation in both infants and children would be helpful in evaluating its role in the development of both emotional expression and emotion understanding. As noted above, studies that utilize EMG may be particularly helpful in bridging the gap between the infant and adult research.

One particularly interesting implication of the above discussion is that focus on facial expressions in emotion recognition research may also require reconsideration from both a theoretical and applied perspective. The extensive literature linking expression recognition to a variety of behavioral outcomes is impressive. For example, Izard, Fine, Schultz, Mostow, Ackerman, and Youngstrom (2001) found that at-risk children's ability to recognize and label prototypic emotion expressions at 5 years of age predicted their social and academic competence at 9 years of age. In a more recent meta-analytic study, Trentacosta and Fine (2009) found a significant (albeit modest) positive relation between children's and adolescents' emotion knowledge and their social competence, while significant (albeit modest) negative relations were found between emotion knowledge and both internalizing problems and externalizing problems. Most emotion knowledge measures included in their meta-analyses focused on recognition of prototypic facial expressions. However, to meaningfully interpret these findings, we must better understand the circumstances under which infants and children (as well as adults) are actually exposed to prototypic facial expressions in the course of their natural social interactions and how recognition of these expressions leads to socially and emotionally competent behavior. As seen in this chapter, the variable relationship between facial expression and other aspects of emotion suggests that emotion recognition studies should include other expressive modalities in addition to facial expression. Even further, emotion recognition studies might adopt a more process-oriented approach, i.e., more systematically investigate the process by which children (as well as adults) integrate the multimodal cues they encounter within a particular situational context in order to draw inferences about the expresser's emotion.

Another issue that is not the topic of this chapter but is of clear relevance is the question of what exactly is emotion. This question was artfully circumvented by implicitly accepting whatever view was held by those whose studies were reviewed. Still, a few comments may be provided here in the interest of encouraging a wider consideration. One increasingly prevalent view of emotion is that it is a constellation of components in which a prototype may indeed be discerned although it may not always appear in nature. Therefore, it may behoove researchers to more explicitly acknowledge that they are studying relations among emotion components (e.g., facial expressions, self-reported experience, physiological responses, functional behaviors) rather than a relation between one (or more)

component and "emotion" as an entity itself. This might help to clarify inconsistencies among some different studies of the same emotion.

In conclusion, emotional facial expressions have played an important role in the history of emotion theory and research. While recent research suggests that this role should be revised in light of recent findings, it also opens doors for an exciting future of both basic and applied investigations of emotional facial expressions. In addition, integrating the findings of researchers studying emotional expression in individuals of different ages can promote a more comprehensive view of both emotion and emotional development.

References

Barrett, L. F. (2017). *How emotions are made: The secret life of the brain*. Boston, MA: Houghton Mifflin Harcourt.

Bennett, D., Bendersky, M., & Lewis, M. (2002). Facial expressivity at 4 months: A context by expression analysis. *Infancy, 3*, 97–113.

Bennett, D., Bendersky, M., & Lewis, M. (2005). Does the organization of emotional expression change over time? Facial expressivity from 4 to 12 months. *Infancy, 8*, 167–187.

Bonanno, G. A., & Keltner, D. (1997). Facial expressions of emotion and the course of conjugal bereavement. *Journal of Abnormal Psychology, 106*, 126–137.

Bridges, K. M. B. (1930). A genetic theory of the emotions. *Journal of Genetic Psychology, 37*, 514–527.

Bridges, K. M. B. (1932). Emotional development in early infancy. *Child Development, 3*, 324–341.

Broesch, T., Rochat, P., Olah, K., Broesch, J., & Henrich, J. (2016). Similarities and differences in maternal responsiveness in three societies: Evidence from Fiji, Kenya, and the United States. *Child Development, 87*, 700–711.

Brooker, R., Kiel, E., & Buss, K. (2016). Early social fear predicts kindergarteners' socially anxious behaviors: Direct associations, moderation by inhibitory control, and differences from nonsocial fear. *Emotion, 16*, 997–1010.

Buss, K. (2011). Which fearful toddlers should we worry about? Context, fear regulation, and anxiety risk. *Developmental Psychology, 47*, 804–819.

Buss, K., & Kiel, E. (2004). Comparison of sadness, anger, and fear facial expressions when toddlers look at their mothers. *Child Development, 75*, 1761–1773.

Camras, L. A., Shuster, M., & Fraumeni, B. (2014). Emotion socialization in the family with an emphasis on culture. In L. Nucci (Series Ed.) & K. Lagattuta (Vol. Ed.), *Contributions to human development: Vol. 26. Children and emotion: New insights into developmental affective science* (pp. 67–80). Basel, Switzerland: Karger.

Camras, L. A. (1992). Expressive development and basic emotions. *Cognition and Emotion, 6*, 269–283.

Camras, L. A. (2011). Differentiation, dynamical integration and functional emotional development. *Emotion Review, 3*, 138–146.

Camras, L. A., Chen, Y., Bakeman, R., Norris, K., & Cain, T. (2006). Culture, ethnicity, and children's facial expressions: A study of European American, Mainland Chinese, Chinese American, and Adopted Chinese girls. *Emotion, 6*, 103–114.

Camras, L. A., Lambrecht, L., & Michel, G. (1996). Infant "surprise" expressions as coordinative motor structures. *Journal of Nonverbal Behavior, 20*, 183–195.

Camras, L. A., Meng, Z., Ujiie, T., Dharamsi, S., Miyake, K., Oster, H., … Campos, J. (2002). Observing emotion in infants: Facial expression, body behavior and rater judgments of responses to an expectancy-violating event. *Emotion, 2*, 178–193.

Camras, L. A., Oster, H., Bakeman, R., Meng, Z., Ujiie, T., & Campos, J. J. (2007). Do infants show distinct negative facial expressions for different negative emotions?: Emotional expression in European-American, Chinese, and Japanese infants. *Infancy, 11*, 131–155.

Camras, L. A., Oster, H., Campos, J., Campos, R., Ujiie, T., Miyake, K., … Meng, Z. (1998). Production of emotional facial expressions in American, Japanese and Chinese infants. *Developmental Psychology, 34*, 616–628.

Camras, L. A., Ribordy, S., Hill, J., Martino, S., Sachs, G., Spaccarelli, S., & Stefani, R. (1990). Maternal facial behavior and recognition and production of emotional expressions by maltreated and nonmaltreated children. *Developmental Psychology, 26*, 304–312.

Camras, L. A., & Shuster, M. (2013). Current emotion research in developmental psychology. *Emotion Review, 5*, 321–329.

Camras, L. A., Sullivan, J., & Michel, G. (1993). Do infants express discrete emotions?: Adult judgments of facial, vocal and body actions. *Journal of Nonverbal Behavior, 17*, 171–186.

Castro, V. L., Camras, L. A., Halberstadt, A. G., & Shuster, M. M. (2017). Children's prototypic facial expressions during emotion-eliciting conversations with their mothers. *Emotion, 18*, 260–276.

Chen, X. (2000). Growing up in a collectivist culture: Socialization and socioemotional development in Chinese children. In H. Communion & V. Gielen (Eds.), *International perspectives on human development* (pp. 331–351). Padua, Italy: Cedam Publishers.

Clark-Polner, E., Wager, T., Satpute, A., & Barrett, L. (2016). Meta-analysis, variation, and the search for brain-based essences in the science of emotion. In L. F. Barrett, M. Lewis, & J. Haviland-Jones (Eds.), *Handbook of emotions* (4rd ed., pp. 146–165). New York, NY: Guilford Press.

Cole, P. (1986). Children's spontaneous control of facial expression. *Child Development, 57*, 1309–1321.

Cole, P., & Moore, G. (2015). About face! Facial expression of emotion. *Emotion Review, 7*, 116–120.

Cole, P., & Tan, P. Z. (2007). Emotion socialization from a cultural perspective. In J. Grusec & P. Hastings (Eds.), *Handbook of socialization: Theory and research* (pp. 516–542). New York, NY: Guilford Press.

Cole, P., Zahn-Waxler, C., & Smith, K. (1994). Expressive control during a disappointment: Variations related to preschoolers' behavior problems. *Developmental Psychology, 30*, 835–846.

Colonnesi, C., Zijlstra, B., van der Zande, A. & Bogels, S. (2012). Coordination of gaze, facial expressions and vocalizations of early infant communication with mother and father. Infant Behavior and Development, 35, 523–532.

Cunningham, W., Dunfield, K., & Stillman, P. (2013). Emotional states from affective dynamics. *Emotion Review, 5*, 344–355.

Dan-Glauser, E., & Gross, J. (2013). Emotion regulation and emotion coherence: Evidence for strategy-specific effects. *Emotion, 13*, 832–842.

Darwin, C. (1872/1998). *The expression of the emotions in man and animals*. New York, NY: Oxford University Press. (Original work published 1872).

Dennis, T., Cole, P., Wiggins, C., Cohen, L., & Zalewski, M. (2009). The functional organization of preschool-age Children's emotion expressions and actions in challenging situations. *Emotion, 9*, 520–530.

Dondi, M., Gervasi, M. T., Valente, A., Vacca, T., Borana, G., Bellis, I., … Oster, H. (2014). Spontaneous facial expressions of distress in fetuses. In C. De Souska (Ed.), *Proceedings of the 14th European Conference on Facial Expression* (pp. 34–47). Portugal: Lisboa.

Duran, J., Reisenzein, R., & Fernandez-Dols, J.-M. (2017). Coherence between emotions and facial expressions: A research synthesis. In J.-M. Fernandez-Dols & J. Russell (Eds.), *The science of facial expression* (pp. 107–132). New York, NY: Oxford University Press.

Eisenberg, N., Cumberland, A., & Spinrad, T. L. (1998). Parental socialization of emotion. *Psychological Inquiry, 9*, 241–273.

Ekman, P. (1972). Universals and cultural differences in facial expressions of emotion. *Nebraska Symposium on Motivation, 19*, 207–282.

Ekman, P., & Friesen, W. (1969). The repertoire of nonverbal behavior: Categories, origins, usage, and coding. *Semiotica, 1*, 49–98.

Ekman, P., & Friesen, W. (1971). Constants across cultures in the face and emotion. *Journal of Personality and Social Psychology, 17*, 124–129.

Ekman, P., Friesen, W., & Ancoli, S. (1980). Facial signs of emotional experience. *Journal of Personality and Social Psychology, 39*, 1125–1134.

Ekman, P., Friesen, W., & Ellsworth, P. (1982). Does the face provide accurate information? In P. Ekman (Ed.), *Emotion in the human face* (2nd ed., pp. 56–97). New York, NY: Pergamon Press.

Ekman, P., & Friesen, W. (1978). *Facial action coding system*. Palo Alto, CA: Consulting Psychologists Press.

Ekman, P., Friesen, W., & Hager, J. (2002). *Facial action coding system*. Salt Lake City, UT: Research Nexus.

Ekman, P., Sorenson, E. R., & Friesen, W. (1969). Pan-cultural elements in facial displays of emotion. *Science, 164*, 86–88.

Elfenbein, H. (2017). Emotional dialects in the language of emotion. In J.-M. Fernandez-Dols & J. Russell (Eds.), *The science of facial expression* (pp. 479–496). New York, NY: Oxford University Press.

Elfenbein, H., & Ambady, N. (2002). On the universality and cultural specificity of emotion recognition: A meta-analysis. *Psychological Bulletin, 128*, 203–235.

Elfenbein, H., Beaupre, M., Levesque, M., & Hess, U. (2007). Toward a dialect theory: Cultural differences in the expression and recognition of posed facial expressions. *Emotion, 7*, 131–146.

Emde, R., & Koenig, K. (1969). Neonatal smiling and rapid eye movement states. *American Academy of Child Psychiatry, 11*, 117–200.

Fernandez-Dols, J.-M. (2013). Advances in the study of facial expressions. *Emotion Review, 5*, 3–7.

Fernandez-Dols, J.-M., & Crivelli, C. (2013). Emotion and expressions: Naturalistic studies. *Emotion Review, 5*, 24–29.

Fernandez-Dols, J.-M., & Russell, J. (2017). Introduction. In J.-M. Fernandez-Dols & J. Russell (Eds.), *The science of facial expression* (pp. 3–14). Oxford, UK: Oxford University Press.

Fogel, A., Nelson-Goens, G., Hsu, H., & Shapiro, A. (2000). Do different infants smiles reflect different positive emotions? *Social Development, 9*, 497–520.

Galati, D., Miceli, R., & Sini, B. (2001). Judging and coding facial expression of emotions in congenitally blind children. *International Journal of Behavioral Development, 25*, 268–278.

Garrett-Peters, P., & Fox, N. (2007). Cross-cultural differences in children's emotional reactions to a disappointing situation. *International Journal of Behavioral Development, 31*, 161–169.

Gartstein, M., & Rothbart, M. (2003). Studying infant temperament via the revised infant behavior questionnaire. *Infant Behavior and Development, 26*, 64–86.

Gaspar, A., & Esteves, F. (2012). Preschooler's faces in spontaneous emotional contexts—How well do they match adult facial expression prototypes? *International Journal of Behavioral Development, 36*, 348–357.

Geangu, E., Quadrelli, E., Conte, S., Croci, E., & Turati, C. (2016). Three-year-olds' rapid facial electromyographic responses to emotional facial expressions and body postures. *Journal of Experimental Child Psychology, 144*, 1–14.

Goldsmith, H., & Rothbart, M. (1993). *The laboratory temperament assessment battery (LAB-TAB)*. Madison, WI: University of Wisconsin.

Halberstadt, A. G., & Eaton, K. (2003). A meta-analysis of family expressiveness and children's emotion expres-

siveness and understanding. *Marriage and Family Review, 34*, 35–62.

Haltigan, J., Leerkes, E., Supple, A., & Calkins, S. (2014). Infant negative affect and maternal interactive behavior during the still-face procedure: The moderating role of adult attachment states of mind. *Attachment and Human Development, 16*, 149–173.

Hatfield, E., Cacioppo, J., & Rapson, R. L. (1994). *Emotional contagion*. Cambridge, UK: Cambridge University Press.

Haviland, J., & Lelwica, M. (1987). The induced affect response: 10-week-old infants' responses to three emotion expressions. *Developmental Psychology, 23*, 97–104.

Hiatt, S. W., Campos, J. J., & Emde, R. N. (1979). Facial patterning and infant emotional expression: Happiness, surprise, and fear. *Child Development, 50*, 1020–1035.

Holodynski, M. (2004). The miniaturization of expression in the development of emotional self-regulation. *Developmental Psychology, 40*, 16–28.

Holodynski, M., & Friedlmeier, W. (2006). *Development of emotions and emotion regulation*. New York: Springer. (Translated by Jonathan Harrow).

Hubbard, J., Parker, E., Ramsden, S., Flanagan, K., Relyea, N., Dearing, K., … Hyde, C. (2004). The relations among observational, physiological, and self-report measures of children's anger. *Social Development, 13*, 14–39.

Izard, C. (1997). Emotions and facial expressions: A perspective from differential emotions theory. In J. Russell & J.-M. Fernandez-Dols (Eds.), *The psychology of facial expression* (pp. 57–77). Cambridge, UK: Cambridge University Press.

Izard, C. E., Hembree, E., Dougherty, L., & Spizzirri, C. (1983). Changes in facial expressions of 2- to 19-month-old infants following acute pain. *Developmental Psychology, 19*, 418–426.

Izard, C. E. (1971). *The face of emotion*. New York, NY: Appleton-Century-Crofts.

Izard, C. E. (1991). *The psychology of emotions*. New York, NY: Plenum Press.

Izard, C. E. (1995). *The maximally discriminative facial movement coding system*. Unpublished manuscript.

Izard, C. E., Dougherty, L., & Hembree, E. (1983). *A system for identifying affect expressions by holistic judgments (AFFEX)*. Newark, NJ: Instructional Resources Center, University of Delaware.

Izard, C. E., Fantauzzo, C. A., Castle, J. M., Haynes, O. M., Rayias, M. F., & Putnam, P. H. (1995). The ontogeny and significance of infants' facial expressions in the first 9 months of life. *Developmental Psychology, 31*, 997–1013.

Izard, C. E., Fine, S., Schultz, D., Mostow, A., Ackerman, B., & Youngstrom, E. (2001). Emotion knowledge as a predictor of social behavior and academic competence in children at risk. *Psychological Science, 12*, 18–23.

Izard, C. E., & Malatesta, C. Z. (1987). Perspectives on emotional development I: Differential emotions theory of early emotional development. In J. D. Osofsky (Ed.), *Handbook of infant development* (2nd ed., pp. 494–554). Oxford, England: John Wiley & Sons.

Kaiser, J., Crespo-Llado, M. M., Turati, C., & Geangu, E. (2017). The development of spontaneous facial responses to others' emotions in infancy: An EMG study. *Scientific Reports, 7*(1), 17500. https://doi.org/10.1038/s41598-017-17556-y

Keller, H. (2017). Culture and development: A systematic relationship. *Perspectives on Psychological Science, 12*, 833–840.

Kohut, S. A., Riddell, R., Flora, D., & Oster, H. (2012). A longitudinal analysis of the development of infant facial expressions in response to acute pain: Immediate and regulatory expressions. *Pain, 153*, 2458–2465.

Kromm, H., Farber, M., & Holodynski, M. (2015). Felt or false smiles? Volitional regulation of emotional expression in 4-, 6-, and 8-year-old children. *Child Development, 86*, 579–597.

Levenson, R., Carstensen, L., Friesen, W., & Ekman, P. (1991). Emotion, physiology, and expression in old age. *Psychology and Aging, 6*, 28–35.

Lewis, M. (2014). *The rise of consciousness and the development of emotional life*. New York, NY: Guilford Press.

Lewis, M., & Ramsay, D. (2005). Infant emotional and cortisol responses to goal blockage. *Child Development, 76*, 518–530.

Lewis, M., Ramsay, D., & Sullivan, M. (2006). The relation of ANS and HPA activation to infant anger and sadness response to goal blockage. *Developmental Psychobiology, 48*, 397–405.

Lin, H.-C., & Green, J. (2009). Infants' expressive behaviors to mothers and unfamiliar during face-to-face interactions from 4 to 10 months. *Infant Behavior and Development, 32*, 275–285.

Lindquist, K. (2013). Emotions emerge from more basic psychological ingredients: A modern psychological constructionist model. *Emotion Review, 5*, 356–368.

Malatesta, C., Grigoryev, P., Lamb, C., Albin, M., & Culver, C. (1986). Emotion socialization and expressive development in preterm and full-term infants. *Child Development, 57*, 316–330.

Malatesta, C., & Haviland, J. (1982). Learning display rules: The socialization of emotion expression in infancy. *Child Development, 53*, 991–1003.

Malatesta-Magai, C., Jonas, R., Shepard, B., & Culver, L. (1992). Type a behavior pattern and emotion expression in younger and older adults. *Psychology and Aging, 7*, 551–561.

Matsumoto, D., Keltner, D., Shiota, M. N., O'Sullivan, M., & Frank, M. (2008). Facial expressions of emotion. In M. Lewis, J. M. Haviland-Jones, L. F. Barrett, & M. (Eds.), *Handbook of emotions* (3rd ed., pp. 211–234). New York, NY: Guilford Press.

Matsumoto, D., Yoo, S., Hirayama, S., & Petrova, G. (2005). Validation of an individual-level measure of display rules: The display rule assessment inventory (DRAI). *Emotion, 5*, 23–40.

Matsumoto, D., Yoo, S., Fontaine, J., Anguas-Wong, A. M., Arriola, M., Ataca, B., … Grossi, E. (2008).

Mapping expressive differences around the world: The relationship between emotional display rules and individualism versus collectivism. *Journal of Cross-Cultural Psychology, 39*, 55–74.

Mauss, I., & Robinson, M. (2005). Measures of emotion: A review. *Cognition and Emotion, 23*, 209–237.

Mauss, I. B., Levenson, R. W., McCarter, L., Wilhelm, F. H., & Gross, J. J. (2005). The tie that binds? Coherence among emotion experience, behavior, and physiology. *Emotion, 5*, 175–190. https://doi.org/10.1037/1528-3542.5.2.175

Meltzoff, A. N. (2005). Imitation and other minds: The 'Like Me' hypothesis. In S. Hurley & N. Chater (Eds.), *Perspectives on imitation: From cognitive neuroscience to social science* (pp. 55–77). Cambridge, MA: MIT Press.

Messinger, D. (2008). Smiling. In M. M. Haith & J. B. Benson (Eds.), *Encyclopedia of infant and early childhood development* (Vol. 3, pp. 186–198). Oxford: Elsevier.

Messinger, D., Dondi, M., Nelson-Goens, G., Beghi, A., Fogel, A., & Simion, F. (2002). How sleeping neonates smile. *Developmental Science, 5*, 48–54.

Messinger, D., Fogel, A., & Dickson, K. (2001). All smiles are positive, but some smiles are more positive than others. *Developmental Psychology, 37*, 642–653.

Messinger, D., Mattson, W., Mahoor, M., & Cohn, J. (2012). The eyes have it: Making positive expressions more positive and negative expressions more negative. *Emotion, 12*, 430–436.

Moore, G., & Calkins, S. (2004). Infants' vagal regulation in the still-face paradigm is related to dyadic coordination of mother-infant interaction. *Developmental Psychology, 40*, 1068–1080.

Neidenthal, P., Wood, A., Rychlowska, M., & Korb, S. (2017). Embodied simulation in decoding facial expression. In J.-M. Fernandez-Dols & J. Russell (Eds.), *The science of facial expression* (pp. 397–414). Oxford, UK: Oxford University Press.

Oostenbroek, J., Slaughter, V., Nielsen, M., & Suddendorf, T. (2013). Why the confusion around neonatal imitation? A review. *Journal of Reproductive and Infant Psychology, 31*, 321–341.

Oster, H. (2005). The repertoire of infant facial expressions: An ontogenetic perspective. In J. Nadel & D. Muir (Eds.), *Emotional development* (pp. 261–292). Oxford, UK: Oxford University Press.

Oster, H., Hegley, D., & Nagel, L. (1992). Adult judgments and fine-grained analysis of infant facial expressions: Testing the validity of *a priori* coding formulas. *Developmental Psychology, 28*, 1115–1131.

Parlade, M. V., Messinger, D. S., Delgado, C. E. F., Kaiser, M. Y., Van Hecke, A. V., & Mundy, P. C. (2009). Anticipatory smiling: Linking early affective communication and social outcome. Infant Behavior & Development, 32, 33–43.

Reissland, N., Francis, B., & Mason, J. (2011). Do facial expressions develop before birth? *PLoS One, 6*, e24081.

Reissland, N., Francis, B., & Mason, J. (2013). Can healthy fetuses show facial expressions of "pain" or "distress"? *PLoS One, 8*, e65530.

Reisenzein, R., Studtmann, M., & Horstmann, G. (2013). Coherence between emotion and facial expression: Evidence from laboratory experiments. Emotion Review, 5, 16–23.

Roben, C., Cole, P., & Armstrong, L. (2013). Longitudinal relations among language skills, anger expression, and regulatory strategies in early childhood. *Child Development, 84*, 891–905.

Rosenberg, E. L., & Ekman, P. (1994). Coherence between expressive and experiential systems in emotion. *Cognition and Emotion, 8*, 201–229.

Saarni, C. (1979). Children's understanding of display rules for expressive behavior. *Developmental Psychology, 15*, 424–429.

Saarni, C. (1984). An observational study of children's attempts to monitor their expressive behavior. *Child Development, 55*, 1504–1513.

Schachter, S., & Singer, J. (1962). Cognitive, social, and physiological determinants of emotional state. *Psychological Review., 69*, 379–399.

Sears, M., Repetti, R., Reynolds, B., & Sperling, J. (2014). A naturalistic observational study of children's expressions of anger in the family context. *Emotion, 14*, 272–283.

Soussignan, R., Dollion, N., Schaal, B., Durand, K., Reissland, N., & Baudouin, J.-Y. (2018). Mimicking facial expressions: How 3–12 month-old infants use the eyes and face of a model, *Cognition and Emotion, 32*, 827–842.

Tarabulsy, G., Provost, M., Deslandes, J., St-Laurent, D., Moss, E., Lemelin, J.-P., … Dassylva, J.-F. (2003). Individual differences in infant still-face response at 6 months. *Infant Behavior & Development, 26*, 421–438.

Thelen, E., Kelso, J., & Fogel, A. (1987). Self-organizing systems and infant motor development. *Developmental Review, 7*, 39–65.

Tracy, J., & Robbins, R. (2004). Show your pride: Evidence for a discrete emotion expression. *Psychological Science, 15*, 194–197.

Trentacosta, C., & Fine, S. (2009). Emotion knowledge, social competence, and behavior problems in childhood and adolescence: A meta-analytic review. *Social Development, 19*, 1–29.

Tronick, E. Z., Als, H., & Brazelton, T. B. (1980). Monadic phases: A structural descriptive analysis of infant–mother normal interaction. *Merrill-Palmer Quarterly, 26*, 3–24.

Tsai, J. (2007). Ideal affect: Cultural causes and behavioral consequences. *Perspectives on Psychological Science, 2*, 242–259.

Tsai, J., Chentsova-Dutton, J., Freire-Bebeau, L., & Przymus, D. (2002). Emotional expression and physiology in European Americans and Hmong Americans. *Emotion, 2*, 380–397.

Tsai, J., Knutson, B., & Fung, H. (2006). Cultural variation in affect valuation. *Journal of Personality and Social Psychology, 90*, 288–307.

Tsai, J., Levenson, R., & Carstensen, L. (2000). Autonomic, subjective, and expressive responses to emotional films in older and younger Chinese Americans and European Americans. *Psychology and Aging, 15*, 684–693.

Tsai, J. L., Louie, J., Chen, E., & Uchida, Y. (2007). Learning what feelings to desire: Socialization of ideal affect through children's storybooks. *Personality and Social Psychology Bulletin, 33*, 17–30.

Underwood, M., & Bjornstad, G. (2001). Children's emotional experience of peer provocation: The relation between observed behavior and self-reports of emotions, expressions, and social goals. *International Journal of Behavioral Development, 25*, 320–330.

van der Schalk, J., Fischer, A., Doosje, B., Wigboldus, D., Hawk, S., Hess, U., & Rotteveel, M. (2011). Congruent and incongruent responses to emotional displays of ingroup and outgroup. *Emotion, 11*, 286–298.

Wagner, H., & Lee, V. (1999). Facial behavior alone and in the presence of others. In P. Philippot, R. Feldman, & E. Coats (Eds.), *The social context of nonverbal behavior* (pp. 262–286). Cambridge, UK: Cambridge University Press.

Whitney, P., & Green, J. (2011). Changes in infants' affect related to the onset of independent locomotion. *Infant Behavior and Development, 34*, 459–466.

Wörmann, V., Holodynski, M., Kärtner, J., & Keller, H. (2012). A cross-cultural comparison of the development of the social smile: A longitudinal study of maternal and infant imitation in 6- and 12-week-old infants. *Infant Behavior and Development, 35*, 335–347.

Wu, D. (1996). Chinese childhood socialization. In M. Bond (Ed.), *The handbook of Chinese psychology* (pp. 143–154). New York, NY: Oxford University Press.

Yale, M., Messinger, D., Cobo-Lewis, A., & Delgado, C. (2003). The temporal coordination of early infant communication. *Developmental Psychology, 39*, 815–824.

Yitzhak, N., Giladi, N., Gurevich, T., Messinger, D., Prince, E., Martin, K., & Aviezer, H. (2017). Gently does it: Humans outperform a software classifier in recognizing subtle, nonstereotypical facial expressions. *Emotion, 17*, 1187–1198.

The Perception of Facial Emotion in Typical and Atypical Development

Laurie Bayet and Charles A. Nelson

Abstract

The ability to perceive emotional facial expressions is an important building block for many aspects of social and emotional functioning. Not surprisingly, this ability emerges early in life, with development continuing through adolescence. We begin this chapter by briefly reviewing current theoretical models of face emotion processing in adults, with a particular emphasis on the neural bases of this ability. We then present an overview of the developmental literature, from birth to late childhood. A secondary focus pertains to atypical patterns of development, in particular, in children with autism and children with an anxiety disorder. In particular, we review the early development and neural basis of attentional biases to fearful or threatening facial emotions, in typical development and as they relate to individual risk profiles for anxiety disorders. Finally, we highlight recent advances in the understanding of the perceived valence of facial expressions in development and the variations of emotional facial expressions perception across different human cultures.

A major component of the human ability to socially connect with other people is the ability to understand and "read" facial emotion. Humans of all cultures, including individuals who are blind (Galati, Sini, Schmidt, & Tinti, 2003), display a variety of spontaneous facial expressions when experiencing different emotions (Duchenne, 1862). The production of facial expressions is a relatively recent adaptation in phylogenetic history, being generally present in mammals but most pronounced in primates (Darwin, 1872). The perception of emotional faces is critical to social functioning and social communication (for a discussion about the definition of social communication in an evolutionary context, see, e.g., Scott-Phillips & Kirby, 2013; Scott-Phillips, 2008) and involves the interplay between emotional and perceptual processes (Tamietto & de Gelder, 2010). The development of emotional face perception is differentially affected by autism spectrum disorders (Dawson, Webb, & McPartland, 2005; Krebs et al., 2011), affective and psychiatric disorders (Brennan, Harris, & Williams, 2014; Leppänen, Milders, Bell, Terriere, & Hietanen, 2004), early visual deprivation (Gao, Maurer, & Nishimura, 2013), and early experiences of violence or neglect (Moulson

L. Bayet (✉)
American University, Department of Psychology, Washington, DC, USA
e-mail: bayet@american.edu

C. A. Nelson
Harvard University, Harvard Medical School and Boston Children's Hospital, Harvard Graduate School of Education, Cambridge, MA, USA

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_6

et al., 2015; Pollak, Cicchetti, Hornung, & Reed, 2000). The adaptive significance of the ability to "read" facial emotion, the relative complexity and evolutionary recentness of this ability, and its sensitivity to a range of conditions and developmental circumstances motivate the investigation of the development and developmental mechanisms of facial emotion perception. As a first step to this end, we briefly review the theoretical models and neural bases of facial emotion perception in adults.

Explaining Emotional Facial Expression Perception: Setting the Stage

Variant and Invariant Streams of Information Embedded in Faces

Faces convey a range of hierarchically embedded information such as gender, race, identity, age, expression, gaze, and speech movements. Facial features that play a particularly important role in discriminating facial expressions include the eye, mouth, and nose regions (Lee & Anderson, 2017; Schyns, Petro, & Smith, 2007). Thus, accurately perceiving facial emotion necessitates the extraction of information from relevant facial features that also carry other information, such as gaze direction or face gender (Burton, Bruce, & Dench, 1993). This embedding of information on different timescales (Jack, Garrod, & Schyns, 2014; Jack & Schyns, 2015) poses specific computational problems related to the need to combine invariance and sensitivity. For example, while humans perceive varying expressions on an individual face (sensitivity), they can extract its identity regardless of its expression (invariance). Such a trade-off is general to the problem of object recognition (Marr, 1982). In the case of faces, this trade-off is commonly understood as the relative dissociation between variant (e.g., emotional expression, gaze direction) and invariant (e.g., identity, gender, race) streams of information within face processing networks, which occurs as a result of the structural encoding of the face (Bruce & Young, 1986). Such dissociation is most evident in behavioral or lesion studies: some patients with acquired brain lesions experience selective behavioral impairments in face identity recognition (i.e., prosopagnosia) but not facial expression recognition, and vice versa (reviewed in Bruce & Young, 1986). This relative dissociation between variant and invariant processing streams for face perception has found additional support from neuroimaging studies (reviewed in Haxby, Hoffman, & Gobbini, 2000) revealing preferential processing of variant, dynamic facial information in the superior temporal sulcus (STS) but preferential processing of invariant, static facial information in the fusiform gyrus (FG). Developmentally, face identity can be extracted independently from expression and vice versa as early as about 7 months of age in human infants (e.g., Nakato, Otsuka, Kanazawa, Yamaguchi, & Kakigi, 2011), suggesting that facial emotion perception prior to this age could be more influenced by face identity, and perhaps other invariant aspects of the face (e.g., gender), than at later ages. For example, infants younger than 6–7 months of age (but not older infants) typically do not dishabituate to different facial expressions when presented by different models but may do so with expressions presented by the same model (Leppänen & Nelson, 2009; Nelson, 1987).

While the dissociation between emotion processing and other aspects of face processing is important to understand in terms of functional specificity and computational trade-offs, this dissociation is not complete (Calder & Young, 2005). Conversely, factors affecting the earliest face processing stages can still affect dynamic and static face processing differentially. For example, a recent case study of a patient with acquired prosopagnosia (a selective impairment in recognizing facial identity) from a bilateral lesion in the occipito-temporal cortex revealed a distinct pattern of impairment in identifying static facial expressions but preserved performance in identifying dynamic expressions with the exception of fear (Richoz, Jack, Garrod, Schyns, & Caldara, 2015). This patient's lesion affected their occipital face area (OFA), involved in extracting facial features, but not the STS, a

higher-order area involved in the multimodal perception of dynamic stimuli (Haxby et al., 2000; Said, Moore, Engell, & Haxby, 2010). Further investigations revealed that this patient was specifically impaired in extracting emotional information from the eye region of the face, even when instructed to do so (Fiset et al., 2017). In summary, a deficit in facial feature processing can cause downstream effects on both identity processing (prosopagnosia) and static emotion processing while relatively sparing dynamic facial emotion processing.

Another line of work that highlights the incomplete segregation of facial emotion processing from other aspects of face processing concerns the integration of information between the processing streams involved in decoding facial expressions specifically versus other aspects of faces. These interactions occur across several levels. For example, angry faces tend to be perceived as more masculine, a bias that can be partly captured by variations in specific facial features such as brow thickness (Bayet, Pascalis, et al., 2015). In another example, event-related potential (ERP) studies in humans reveal an early (170 ms) sensitivity to emotional facial expressions, followed by gaze direction (190 ms) and finally (200–300 ms) the conjunction of expression and gaze (Conty, Dezecache, Hugueville, & Grezes, 2012). Similarly, smiling expressions act as cues to face familiarity in behavioral tasks (Baudouin, Gilibert, Sansone, & Tiberghien, 2000), information typically associated with modulations of neural responses around 250 ms (Schweinberger, Pickering, Jentzsch, Burton, & Kaufmann, 2002). The mechanism underpinning these perceptual biases is unknown but may include an inference based on the typical association of familiarity and smiling in everyday experience.

Finally, interactions between emotional expression and other facial dimensions may involve higher-level cognitive processes including stereotypes or other semantic knowledge that is not rooted in perceptual experience. For example, white American adults (Hehman, Ingbretsen, & Freeman, 2014) and children as young as 4 years (Dunham, Chen, & Banaji, 2013) tend to associate Black- or African-American faces with the emotion of anger. A recent fMRI study has identified the fusiform gyrus and the orbitofrontal cortex as possible neural loci of this effect of stereotypes on social perception (Stolier & Freeman, 2016). Thus, our understanding of the development of the ability to perceive facial emotion must account for the development of these complex interactions between facial emotion perception and other aspects of face processing including identity, gaze, race, and gender.

The Perception of Emotional Faces in the Brain

The perception of emotional facial expressions in the human brain engages both visual and emotional processing pathways (Adolphs, Damasio, Tranel, & Damasio, 1996; Tamietto & de Gelder, 2010; Vuilleumier, 2005; for a meta-analysis, see, e.g., Fusar-Poli et al., 2009). After early, feature-based processing in the OFA, facial expression processing is thought to be continued in the STS and to a lesser extent in the FFA (Haxby et al., 2000; Said, Haxby, & Todorov, 2011). Cortical and subcortical structures involved in emotion processing include the amygdala nuclei (Ahs, Davis, Gorka, & Hariri, 2014), the pulvinar, the orbitofrontal cortex (OFC), and the anterior cingulate cortex (ACC), among others (Kesler-West et al., 2001; Said et al., 2011; Tamietto & de Gelder, 2010; Vuilleumier, 2005). While the specific, causal function of subcortical (versus cortical) structures in processing facial emotion remains debated, their general involvement is not (de Gelder, van Honk, & Tamietto, 2011; Pessoa & Adolphs, 2010, 2011). Similarly, while there is little doubt that emotion processing pathways (e.g., involving the pulvinar) exist alongside and in interconnection with the primary visual pathway, their specific role and importance remain unclear and are difficult to test (de Gelder et al., 2011; Pessoa & Adolphs, 2010, 2011).

It has also been suggested that motor or somatosensory portions of the cortex could play

a role in processing facial emotion, perhaps related to motor mirroring (Said et al., 2011). For example, the frontal operculum (FO) is more activated by emotional than neutral facial expressions during passive viewing (Montgomery & Haxby, 2008). However, its causal role remains unclear, as is the role of the *production* of facial expressions in *perceiving* facial expressions. For example, it is interesting to note that deficits in identifying but not imagining facial expressions have been reported in adults with bilateral facial paralysis from Moebius syndrome (Bate, Cook, Mole, & Cole, 2013; Bogart, Matsumoto, & Bogart, 2010; Calder, Keane, Cole, Campbell, & Young, 2000). However, these deficits may stem from more general impairments in oculomotor control (Bate et al., 2013), which are essential to optimal face perception, including emotional facial expressions (e.g., Peterson & Eckstein, 2012).

Given the large number of cortical and subcortical areas involved in processing emotional facial expressions, it is important to note that only a small number of these areas are routinely accessible by common spatially resolved neuroimaging techniques used in developmental studies involving infants or very young children. Functional near-infrared spectroscopy (fNIRS), most notably, provides good coverage of superficial cortical areas (Minagawa-Kawai, Mori, Hebden, & Dupoux, 2008). Importantly, in the case of facial emotion processing, these regions include the STS (Nakato et al., 2011), frontal regions (Minagawa-Kawai et al., 2009), and occipital regions of the superficial cortex. Neural activity in the fusiform gyrus, while inaccessible by fNIRS, can be at least partly recovered from electroencephalography (EEG) (Guy, Zieber, & Richards, 2016; Johnson et al., 2005). However, subcortical structures (such as the amygdala or pulvinar) are usually considered inaccessible by EEG or fNIRS. Future progress in source reconstruction methods for EEG or magnetoencephalography (MEG) signals in developmental participants (Guy et al., 2016; Kuhl, Ramirez, Bosseler, Lin, & Imada, 2014; Lew et al., 2013), as well as future advances in pediatric functional magnetic resonance imaging (Deen et al., 2017; Weaver, 2015), may help in unveiling the involvement of ventral or subcortical structures in facial emotion processing early in life.

In addition to spatially resolved neuroimaging methods, time-resolved methods such as EEG or MEG have revealed the time-course of emotional facial expression processing in human adults. EEG studies in adults have shown that the face-sensitive ERP N170, a negative component measured at temporal electrodes at a latency of about 170 ms, is sensitive to specific emotional facial expressions (Batty & Taylor, 2003; Eimer & Holmes, 2007; Leppänen, Moulson, Vogel-Farley, & Nelson, 2007; Luo, Feng, He, Wang, & Luo, 2010; Schyns et al., 2007). The amplitude of the earlier component P1, measured occipitally at a latency of about 100 ms, also appeared to be modulated by emotional facial expressions, at least when contrasting emotional to neutral expressions (Batty & Taylor, 2003; Leppänen et al., 2007; Luo et al., 2010; Vlamings, Goffaux, & Kemner, 2009). In this context, it is interesting to note that the neural source of the N170 is estimated to be localized in the fusiform gyrus (Deffke et al., 2007) and the STS (Itier & Taylor, 2004).

A joint ERP-fMRI study found that trial-level modulations of N170 amplitude in an emotion perception task correlated with trial-level modulations of amygdala activity measured with concurrent fMRI (Conty et al., 2012), suggesting that the amygdala could be sensitive to facial emotions at this latency. MEG and intracranial EEG have been used to directly examine the time-course of neural activity in the amygdala (versus extra-striate visual cortex) in response to emotional faces in general and fearful faces in particular, with relatively mixed results (Dumas et al., 2013; Garvert, Friston, Dolan, & Garrido, 2014; Krolak-Salmon, Hénaff, Vighetto, Bertrand, & Mauguière, 2004). Overall, the evidence suggests that emotional facial expressions are extracted alongside other aspects of the face from at least 170 ms in the adult human brain.

Most of the neuroimaging or electrophysiological studies reviewed so far concern where or

when in the brain facial emotions are differentiated. Such a direct approach has considerable merit, but its first theoretical limitation is that interpreting facial emotions often requires the integration of other emotional cues (e.g., body posture, tone of voice) as well as an understanding of how the current context is likely to cause specific emotional experiences (Barrett, Mesquita, & Gendron, 2011; Hassin, Aviezer, & Bentin, 2013; Saxe & Houlihan, 2017). A second, related theoretical limitation of this approach is that perceiving a facial emotion in isolation from other cues and the broader context is often insufficient to produce an adaptive response: for example, an adaptive response to an angry face clearly depends on whether the angry expression is directed at the observer or not (Conty et al., 2012). Both limitations highlight the importance of appraisal in interpreting facial expressions, inferring the underlying emotional experience of the producer, and selecting an adaptive response.

Recent neuroimaging research has shown, for example, that supra-modal representations of other people's emotional experiences can be extracted from neural activity in the medial prefrontal cortex (MPFC), which could be a locus for integrating emotional cues originating from context understanding and person perception (Peelen, Atkinson, & Vuilleumier, 2010; Skerry & Saxe, 2014). Electrophysiological approaches have demonstrated the time-course of emotional cue integration in the human brain, such as the integration of gaze, gesture, and emotional cues (Conty et al., 2012). Computational studies have shown how Bayesian models can capture human inferences in the emotional domain (Ong, Asaba, & Gweon, 2016; Saxe & Houlihan, 2017). These lines of research highlight the need to understand how during development the perception of emotional facial expressions is integrated with that of other cues to produce an adaptive response and an understanding of other people's emotions in context.

Early Development: From Birth to Toddlerhood

Facial emotion perception engages a complex and efficient processing network. Understanding the development of this ability uniquely illuminates the mechanisms by which such a network is built in human ontogeny. These developmental insights may help elucidate how atypical processes lead to social or emotional disorders in adulthood and shed light on the experience-dependent nature of facial emotion perception more generally. Because developmental studies of facial emotion perception in infants and toddlers typically employ different methods than studies in children and adolescents, here we review the literature on these two developmental periods separately starting with early development. Developmental studies of facial emotion processing in the first 2 years of life (for reviews see, e.g., Leppänen & Nelson, 2009; Nelson, 1987) have pointed to a developmental change in the perception and discrimination of certain isolated expressions between 5 and 7 months of age and to the emergence of contextual understanding toward the end of the first year.

Emotional Facial Expression Perception in Very Young Infants

Newborns and fetuses from 24 weeks of gestation can produce facial expressions, within the range of their facial motor repertoire (Reissland, Francis, Mason, & Lincoln, 2011; Steiner, 1979; Steiner, Glaser, Hawilo, & Berridge, 2001; Trapanotto et al., 2004). Perceiving, discriminating, and identifying facial expressions of emotion follow a more protracted developmental trajectory. Relatively few studies have examined the perception of facial emotion in infants under the age of 4–5 months, and methodological difficulties complicate the

interpretation of existing studies. A large body of work has examined the ability of newborns and infants under 2 months of age to imitate live, dynamic facial expressions such as smiling or tongue protrusion (for a review, see, e.g., Oostenbroek, Slaughter, Nielsen, & Suddendorf, 2013). However, the existence, limits, and mechanism (e.g., arousal response, reflex, or motor mirroring) of neonatal imitation remain quite controversial due to differences in experimental controls and parameters across studies (Coulon, Hemimou, & Streri, 2013; Kaitz, Meschulach-Sarfaty, Auerbach, & Eidelman, 1988; Meltzoff et al., 2018; Meltzoff & Moore, 1977, 1983; Oostenbroek et al., 2013, 2016).

The imitation of tongue protrusion appears to be the more reliable form of neonatal imitation (Meltzoff et al., 2018), but how this behavior relates to emotional facial expression is unclear. At the very least, it appears that newborns and very young infants can differentiate between high-intensity, live dynamic expressions of surprise, sadness, or smiling produced by a live female model, as measured by behavioral habituation-dishabituation (Field, Woodson, Greenberg, & Cohen, 1982). More recent studies using static pictures of emotional facial expressions have additionally shown that newborns will look longer toward smiling than neutral or fearful female faces in paired preferential looking paradigms (Farroni, Menon, Rigato, & Johnson, 2007; Rigato, Menon, Johnson, & Farroni, 2011) and that newborns do not differentiate neutral and fearful female faces in behavioral habituation-dishabituation paradigms (Farroni et al., 2007).

These results can be interpreted in the light of the limitations in visual acuity in newborns and young infants (e.g., discussed in Nelson, 1987), as well as of the converging evidence that dynamic movement plays an important role in the perception of newborns and young infants (e.g., Kellman & Spelke, 1983). As a result, studies using static pictures may underestimate the perceptual abilities of newborns and young infants in less controlled situations. Similarly, higher facial expression discrimination performance is evident in young (4-month-old) infants using audiovisual presentations, as opposed to unimodal stimuli (Flom & Bahrick, 2007). Similar studies in infants younger than 5 months of age have generally reported a visual preference for smiling over frowning or neutral faces, at least under some conditions (Bayet, Quinn, et al., 2015; Kuchuk, Vibbert, & Bornstein, 1986; La Barbera, Izard, Vietze, & Parisi, 1976), which could reflect the relative familiarity of this salient and positive expression (Malatesta, Grigoryev, Lamb, Albin, & Culver, 1986). Five-month-old infants do not exhibit the same looking preference for smiling faces (Peltola, Leppänen, Mäki, & Hietanen, 2009) but show some ability to differentiate smiling from sad (Caron, Caron, Maclean, & Url, 1988), fearful (Bornstein & Arterberry, 2003), neutral (Bornstein, Arterberry, Mash, & Manian, 2011), and, in some cases, surprise (Caron, Caron, & Myers, 1982; Young-Browne, Rosenfeld, & Horowitz, 1977) expressions.

However, typically the ability to differentiate facial emotions diminishes (but see Bornstein & Arterberry, 2003; Caron et al., 1982; Serrano, Iglesias, & Loeches, 1992) as habituation-dishabituation paradigms become more demanding by varying the identity of the model between habituation and testing or throughout both habituation and testing ("generalized discrimination"). Smiling versus angry expressions appear to be particularly confusing for infants at this age (but see Serrano et al., 1992), perhaps due to the presence of exposed teeth in both of these facial expressions (Caron, Caron, & Myers, 1985; Oster, 1981). Interestingly, at least two studies have reported interactive effects of gaze and facial emotion perception in 3- to 4-month-old infants when ERPs are utilized, namely, the interaction of fear with averted gaze (Hoehl, Wiese, & Striano, 2008) and the interaction of anger with direct gaze (Striano, Kopp, Grossmann, & Reid, 2006). In Hoehl et al. (2008), the amplitude of the Nc (negative central) ERP component was found to be larger at the right frontoparietal sites in response to objects that had been previously presented with a fearful face gazing toward it, compared to objects that had been previously presented

with a neutral face gazing toward it. The effect was absent when faces were gazing away from the object or when the faces were gazing toward a different object than the one presented at test. In Striano et al. (2006), the amplitude of the PSW (positive slow wave) component was found to be larger in response to angry faces with direct compared to averted gazed; the effect was absent for happy or neutral faces. Overall, young infants appear to show burgeoning abilities to differentiate between several emotional facial expressions, including the ability to respond differentially to some expressions as a function of gaze direction, and show a visual preference for smiling faces in some conditions. However, their processing strategies appear more reliant on specific features (e.g., teeth) rather than the extraction of expressions invariantly from the identity of the face.

A current, open question regarding the perception of facial emotion by very young infants and newborns concerns the role of familiarity and experience in shaping this ability. Interestingly, infants from the age of at least 4 months appear to expect adults to produce facial expressions in social interactions, as evidenced in the still-face paradigm (Rochat, Striano, & Blatt, 2002), demonstrating expectations that reflect their everyday experiences (Malatesta et al., 1986). Studies of 5-month-old infants of clinically depressed mothers, who are less likely to produce facial expressions in general and positive expressions in particular, do show delays in discriminating facial expressions (Bornstein et al., 2011); these perceptual delays however do not appear specific to discriminating facial expressions and extend to discriminating objects (Bornstein, Mash, Arterberry, & Manian, 2012). Maternal characteristics (positive emotionality, sensitive parenting style, or anxiety) more generally appear to affect facial emotion processing in older, 7-month-old (de Haan, Belsky, Reid, Volein, & Johnson, 2004; Taylor-Colls & Pasco Fearon, 2015) as well as 9-month-old infants (Otte, Donkers, Braeken, & Van den Bergh, 2015).

Studies comparing infants' discrimination of facial emotions produced by familiar (caregiver) or unfamiliar (stranger) models have demonstrated improved discrimination of expressions from caregivers (versus strangers) at 3.5 months (Kahana-Kalman & Walker-Andrews, 2001; Montague & Walker-Andrews, 2002) but not at 6.5 months (Safar & Moulson, 2017). At least one study has found an effect of face gender on the looking preferences of 3.5-month-olds for smiling versus neutral expressions (Bayet, Quinn, et al., 2015), which could be due to experience as female faces are typically more familiar to infants due to imbalances in caregiving patterns across genders (Ramsey-Rennels & Langlois, 2006; Rennels & Davis, 2008; Sugden, Mohamed-Ali, & Moulson, 2014).

In short, some evidence suggests that expressions from familiar faces may be better perceived by very young infants and that their perception of emotions could be additionally shaped by perceptual experience with faces across the dimensions of gender and race. Theoretically, this could be explained by a relative deficit in structural encoding (e.g., separation of emotion from identity, race, or gender) in young infants (Gliga & Dehaene-Lambertz, 2005; Kobayashi et al., 2011; Kobayashi, Otsuka, Kanazawa, Yamaguchi, & Kakigi, 2012; Nakato et al., 2009, 2011). In other words, the perception of facial emotion could be more integrated with other aspects of the face in very young infants. However, definite evidence for a role of experience in shaping emotional facial expressions perception in early infancy is currently lacking. Future research in this areas as well as larger scale studies that parametrically map the limits of dynamic and static facial expression perception in newborns in young infants will help clarifying the critical experiences and building blocks that set the stage for the emergence of more mature emotional facial expressions perception abilities during the second half of the first year of life.

Early Biases Toward the Facial Expression of Fear

A striking feature of early facial emotion perception abilities in the second half of the first year of life is an attentional bias toward fearful faces emerging between the ages of 5 and 7 months. This fear bias has been evidenced across a range of experimental paradigms and measures, including behavioral, electrophysiological, and physiological measures (Leppänen & Nelson, 2012). For example, 7- but not 5-month-old infants exhibit a visual preference (i.e., longer looking times) for fearful over smiling faces (Leppänen et al., 2007; Nelson & Dolgin, 1985), although a preference for smiling versus neutral, angry, or sad faces may also still be observed (La Barbera et al., 1976; Soken & Pick, 1999; Striano, Brennan, & Vanman, 2002). In a similar vein, 7-month-old infants habituate more slowly to fearful than to smiling expressions (Nelson, Morse, & Leavitt, 1979). At the same age, a central fearful face will increase saccadic reaction times to a peripheral target compared to a central neutral or smiling face, or even to a neutral face with fearful eyes (Peltola, Leppänen, Mäki, et al., 2009; Peltola, Leppänen, Palokangas, & Hietanen, 2008; Peltola, Leppänen, Vogel-Farley, Hietanen, & Nelson, 2009). Importantly, the effect is not replicated by a neutral face with fearful eyes (Peltola, Leppänen, Vogel-Farley, et al., 2009), or a cheek blowing expression, which is potentially as novel to infants as the fearful expression (Peltola et al., 2008). Taken together, these results suggest that the fearful expression itself is attention-grabbing, although it is always possible that the fearful expression is relatively more novel than other expressions in infancy. Documenting the real-life experience of infants with facial expressions using head-mounted cameras (Sugden et al., 2014) will help in disambiguating these alternative explanations.

The attention holding effect of fearful faces at this age is further demonstrated by stronger orienting responses to fearful than smiling faces as indexed by cardiac deceleration (Leppänen et al., 2010; Peltola, Leppänen, & Hietanen, 2011). However, pupil dilation, another index of orienting and arousal, shows the opposite pattern, that is, stronger response to smiling than fearful faces (Jessen, Altvater-Mackensen, & Grossmann, 2016). Infants also do not appear to experience any overt distress or fear in response to fearful faces. ERP responses in 7- but not 5-month-olds additionally reveal a modulation of the Nc (negative central), an ERP component related to attention (Reynolds & Richards, 2005), by fearful versus happy faces (Jessen & Grossmann, 2015; Leppänen et al., 2007; Nelson & De Haan, 1996). The effect may be observed even when fearful and happy faces are presented below the psychophysical threshold for consciousness (Jessen & Grossmann, 2014, 2015, 2016). Intriguingly, conscious processing of fearful faces is also associated with a modulation in face-sensitive ERPs, suggesting the allocation of increased cortical processing resources (N290, P400; Jessen & Grossmann, 2015; Leppänen et al., 2007).

The fear bias appears to decrease in strength toward the end of the first year of life (Peltola, Hietanen, Forssman, & Leppänen, 2013). Importantly, however, the attentional bias to fear at 7 months is sensitive to individual genetic variations in serotonin synthesis pathways as well as to current maternal stress and depression, which are both relevant to later social-emotional development and function (Forssman et al., 2014), and is predictive of attachment security in toddlerhood as measured in a standardized behavioral task (Peltola, Forssman, Puura, Van Ijzendoorn, & Leppänen, 2015). This suggests that the fear bias at 7 months could act as an early marker of and precursor to social-emotional development.

A robust body of work has demonstrated the emergence of a fear bias between the ages of 5 and 7 months, but it is unknown whether this emergence represents a discrete developmental shift. For example, it has been suggested that the emergence of the fear bias could reflect the onset of functional connections between emotion processing and attentional networks (Leppänen & Nelson, 2009). Animal models additionally suggest that such a shift could correspond to the closing of a critical period for familiarity

formation and the onset of fear learning in development (Leppänen & Nelson, 2012). Unfortunately, limitations in the functional neuroimaging of the infant brain during visual tasks and, more specifically, its current restriction to cortical structures on the surface of the brain (Minagawa-Kawai et al., 2008; but see Biagi, Crespi, Tosetti, & Morrone, 2015; Deen et al., 2017; Tzourio-Mazoyer et al., 2002) have prevented from testing this hypothesis directly. Most notably, recent resting-state fMRI studies suggest that functional connections between the amygdala and cingulate and frontal cortices are present at rest from birth (Graham, Pfeifer, Fisher, Carpenter, & Fair, 2015; Rogers et al., 2017; Sylvester et al., 2018); however, it remains unknown whether such functional connections are more active in response to facial emotions (for fMRI data on auditory emotion processing in infants, see, e.g., Blasi et al., 2011; Graham, Fisher, & Pfeifer, 2013).

Alternatively, the emergence of the attentional fear bias at 7 months could reflect the maturation of attentional networks more generally. It has also been proposed that low-level perceptual biases could guide the emergence of attentional biases to fear, followed by fear learning; indeed, there is behavioral evidence for the emergence of perceptual or attentional biases (attention-grabbing, faster detection, or better detection) to threatening stimuli (shape and spider shapes, angry faces, and fearful faces) in young infants both before and after the pivotal age of 7 months (Bayet et al., 2017; DeLoache & LoBue, 2009; Heck, Hock, White, Jubran, & Bhatt, 2016; LoBue, 2012; LoBue & Deloache, 2010; LoBue & Rakison, 2013; LoBue, Rakison, & DeLoache, 2010). Some ERP studies also suggest that some sensitivity to fearful versus smiling faces exists before the age of 7 months, although to a much lesser degree and less robustly so than at 7 months, again suggesting a possibly more continuous development of fear processing during the first year than suggested by earlier studies. For example, a sensitivity to fear has been evidenced by finer analyses of ERP data at 5 months (Yrttiaho, Forssman, Kaatiala, & Leppänen, 2014), and in an object referencing ERP paradigm at 3.5 months (Hoehl et al., 2008).

As studies of young infants tend to be relatively small-scaled (Oakes, 2017), replicating these results in larger, ideally longitudinal samples will be instrumental in uncovering the developmental trajectory of fearful faces and threat perception across the first year of life. Taken together, these results in young infants still provide modest evidence (but see Grossmann & Jessen, 2017) against the notion that the emergence of the attentional fear bias is causally triggered by the onset of locomotion (Heck et al., 2016), as infants are generally unlikely to be mobile as early as 5 months of age. However, as previously suggested (Leppänen & Nelson, 2009, 2012) on the basis of animal models (e.g., Sullivan & Holman, 2010), the developmental time-locking between the onset of a robust perception of fearful faces and threat sensitivity and the onset of locomotion and independent exploration may still have been evolutionary selected for its adaptiveness—even though those events are not directly and causally related in ontogeny.

Categorical Representation of Facial Emotions Across Different Identities

As sensitivity to different facial expressions may be driven by irrelevant features, or be driven by low-level perceptual properties of these expressions, an important line of research has assessed whether and when the perception of emotional facial expressions emerges as truly categorical (for a review, see, e.g., Leppänen & Nelson, 2009; Nelson, 1987). Experimentally, this has involved modifying standard habituation-dishabituation procedures so that the exemplars for each emotional category presented during habituation and test show sufficient variety (e.g., different models). In doing so, the modified habituation-dishabituation task measures the ability to extract the emotion information itself invariantly from model identity or other aspects, i.e., exhibit generalized discrimination (Nelson & Dolgin, 1985). Such identity-invariant,

categorical discrimination of smile and several other emotions (surprise, sadness, fear) is clearly evident from 6 to 7 months of age in infants (e.g., Caron et al., 1982; Ludemann & Nelson, 1988; Nelson et al., 1979; Nelson & Dolgin, 1985). However, no evidence has been found for a valence-based categorization of emotional expressions at this age (Ludemann, 1991). An additional way to test for categorical representations of emotional facial expressions is to test for the existence of categorical boundary effects, i.e., stronger dishabituation to novel stimuli that cross the boundary of the habituated category than to novel stimuli that do not, given the same perceptual distance. Again, this approach has demonstrated the existence of a categorical boundary between fear and smiling expressions in 7-month-old infants (Kotsoni, de Haan, & Johnson, 2001).

In addition to these behavioral studies, ERP and fNIRS studies provide insights in the time-course and cortical areas involved in processing emotional facial expressions at 7 months of age. In line with results in adults, fNIRS studies have shown differential responses to angry and smiling expressions in temporal cortical areas, which could correspond to the STS (Nakato et al., 2011). ERP studies have shown differences, in particular larger amplitudes for face- and attention-related components (N290, Nc, P400), in response to fearful compared to smiling or neutral expressions at this age (Jessen & Grossmann, 2015; Leppänen et al., 2007; Nelson & De Haan, 1996; Peltola, Leppänen, Mäki, et al., 2009). However, larger amplitudes for these components were found in older, 9- to 10-month-olds in response to smiling versus fearful or neutral faces (van den Boomen, Munsters, & Kemner, 2019). ERP studies comparing responses to fearful and angry faces (Hoehl & Striano, 2008; Kobiella, Grossmann, Reid, & Striano, 2008; Nelson & De Haan, 1996), or smiling and angry faces (Grossmann, Striano, & Friederici, 2007), have had more mixed results but generally reported different responses to these expressions at 7 months (but see Nelson & De Haan, 1996), as measured by face- and attention-related components (N290, Nc, P400).

Cross-modal matching, suggestive of an abstract representation of emotional categories, has also been evidenced at this age for smiling and angry expressions in behavioral and ERP paradigms (Grossmann, Striano, & Friederici, 2006; Soken & Pick, 1992). Of particular note is a recent ERP study conducted in 9- to 10-month-old infants, which focused on the effect of low (coarse) and high (fine) spatial frequency information in processing smiling, fearful, and neutral facial emotions in infancy (van den Boomen et al., 2019). Low spatial frequency information plays an important role in facial emotion processing in adults (Vuilleumier, Armony, Driver, & Dolan, 2003). However, in that study, face-sensitive components (N290, P400) were found to be significantly modulated by emotion only when high spatial frequency information was presented, with higher amplitudes for smiling than fearful or neutral expressions (van den Boomen et al., 2019). However, an attention-related component (Nc) was modulated by emotion for both low and high spatial frequency stimuli, with a more negative amplitude for smiling than fearful or neutral expressions (van den Boomen et al., 2019). These results are in line with the notion that infants' (Dobkins & Harms, 2014) and children's (Vlamings, Jonkman, & Kemner, 2010) face processing is more reliant on high-frequency information, relative to their acuity, than adults.

Overall, behavioral and neuroimaging studies converge to suggest that the 6–7-month period corresponds to the developmental emergence of emotional facial expression perception abilities organized around a few categories that include smiling, fear, and anger.

Emergence of Contextual Understanding

While younger infants demonstrate sensitivity to some emotional facial expressions, toward the end of the first year of life, infants additionally begin to integrate their perception of facial expressions within their growing understanding of context and social interactions. In particular,

toward the end of the first year of life, infants begin to demonstrate at least some understanding of the relations between facial expressions and internal states. For example, 8- to 10-month-old infants expect agents who achieve their goals to display a positive (smile) rather than negative (sad) expression (Skerry & Spelke, 2014). Conversely, 12-month-olds show evidence of expecting agents who look to one of two objects and display a positive expression toward it to reach to that object over another (Phillips, Wellman, & Spelke, 2002). Taken together, these results suggest that toward the end of the first year of life, infants connect positive displays of emotion with achieving goals, which perhaps represents one essential step toward building a theory of mind and an understanding of emotions (e.g., Wu & Schulz, 2018).

In addition, at the end of the first year at least, infants appear to respond more strongly, and possibly attribute a higher positive value, to smiles from their own mother compared to smiles from a stranger (Minagawa-Kawai et al., 2009). More specifically, a fNIRS study found increased activation in the orbitofrontal cortical region of 9- to 13-month-old infants (mean age 11.7 months) in response to their own mother smiling, compared to a neutral expression; less activation was found in response to smiles from a female stranger (Minagawa-Kawai et al., 2009). Because the orbitofrontal cortex is involved in emotion and reward processing, this could mean that infants at this age perceive their mother's smiles as particularly rewarding, indicating that at this age, familiarity and attachment already shape infants' emotional response to smiles.

In addition to an increased contextual understanding of facial expressions in respect to goals and familiar relationships, and in line with their more complex understanding of social situations, infants toward the end of the first year appear to actively seek information from the facial expressions of their caregivers when faced with an ambiguous situation (e.g., a novel toy)—a behavior known as social referencing (Feinman, 1982; Nelson, 1987; Smith & Walden, 1998; Walden & Ogan, 1988). For example, 12-month-olds will actively look for their mother's face in a context of uncertainty and sometimes alter their behavior if the mother displays a negative (e.g., fearful expression) expression (Sorce, Emde, Campos, & Klinnert, 1985).

However, not all infants actually exhibit social referencing in ambiguous situations, and of those who do, not all of them seem to actually use the information gathered to guide their own behavior (e.g., Sorce et al., 1985; also discussed in Nelson, 1987). In more constrained behavioral studies, infants watch an adult display a facial expression directed at one of two novel objects, and the behavior (e.g., looking, reaching) of the infant toward both objects is compared. Even very young (3–6 months) infants demonstrate increased attention to novel objects that were referenced with a fearful or surprised face by an adult, while older (8–9 months and above) infants appear to demonstrate a more contextual and integrated understanding of these situations. That is, older infants do not allocate additional attention to harmless, nonambiguous toys even if they were referenced by an agent with a fearful expression (Hoehl & Pauen, 2011; Hoehl & Striano, 2010; Pauen, Birgit, Hoehl, & Bechtel, 2015). Intriguingly, one emerging finding from this literature has been the notion of a negativity bias, i.e., that infants (and adults) use negative emotions more than positive emotions when learning, attending, and interacting with objects and agents (Vaish, Grossmann, & Woodward, 2008, 2015). While discussing the negativity bias falls outside of the scope of this chapter, it is interesting to note that such bias can be understood as encompassing the perceptual and attentional fear bias found in infants around the age of 7 months. Biases in attention in young infants, and biases in referencing in older infants, could reflect the same underlying bias toward negative valence in attention and learning.

Childhood and Adolescence

Studies examining the development of emotional facial expression perception in childhood and adolescence have typically been complicated by difficulties in equating task difficulty (e.g., verbal

difficulty associated with producing or understanding emotion labels) across different age groups or tasks, accounting for differences in variability and noise levels across age groups (e.g., in neuroimaging studies), and teasing out the effects of perceptual, emotional, and cognitive development on task performance. The relative lack of studies targeting early childhood (13–48 months of age) additionally obfuscates the trajectory of facial emotion perception between infancy and childhood. Despite such difficulties, there is now a large body of data documenting typical and atypical developmental trajectories of facial emotion perception during childhood and adolescence.

Typical Trajectories

The perception of facial emotion has been assessed in childhood with a variety of tasks such as sorting, matching, or labeling. Typical performance increases with age but depends heavily on the specific task and facial emotions presented (for a review, see, e.g., Gross & Ballif, 1991; Herba & Phillips, 2004; Vicari, Reilly, Pasqualetti, Vizzotto, & Caltagirone, 2000). For example, performance in facial emotion labeling tasks reflects children's understanding of emotion labels (Vicari et al., 2000). However, understanding emotion labels is not the sole driving force in the development of emotion identification, as emotion identification is generally more accurate for faces than voices in early childhood (Chronaki, Hadwin, Garner, Maurage, & Sonuga-Barke, 2015). Smiling facial expressions are identified earliest and most accurately, followed by angry facial expressions (Durand, Gallay, Seigneuric, Robichon, & Baudouin, 2007; Gao & Maurer, 2009, 2010; Gosselin, Roberge, & Lavallée, 1995; Mancini, Agnoli, Baldaro, Ricci Bitti, & Surcinelli, 2013; Montirosso, Peverelli, Frigerio, Crespi, & Borgatti, 2010; Rodger, Vizioli, Ouyang, & Caldara, 2015; Székely et al., 2011; Widen & Russell, 2003). The identification of sad, neutral, surprised, fearful, or disgusted (often confused with anger in children; Widen & Russell, 2013) expressions follows a more protracted developmental trajectory throughout childhood and up to early adolescence (Camras & Allison, 1985; Gosselin et al., 1995; Mancini et al., 2013; Rodger et al., 2015; Rottman, 2014).

While the driving forces behind these developmental trajectories in childhood remain unclear, it has been suggested that they reflect the progressive refinement of emotional categories, from broad categories of happiness and anger or sadness to subtler emotional distinctions such as disgust versus anger (Widen, 2013; Widen & Russell, 2003, 2008). Studies of the composite face effect (where the processing of a part of a face is impaired by alignment with a counterpart from another face) have additionally shown that children from the age of at least 5 years use holistic (Maurer, Le Grand, & Mondloch, 2002) information for emotional faces identification (Durand et al., 2007). Recent studies have also investigated perceptual thresholds for the identification of emotional facial expressions, using stimuli mixed with noise (Rodger et al., 2015), or expressions of varying intensity (Gao & Maurer, 2009, 2010). Those studies have provided normative data on the thresholds for facial emotion identification in typically developing children and confirmed the higher accuracy for the identification of smiling faces in childhood. The identification of "basic" facial emotions (such as anger, sadness, smiling, or fear) appears adult-like by early adolescence, as measured in such behavioral tasks. In contrast, the identification of complex, social emotions such as contempt or sexual interest continues to develop through adolescence and might be driven by pubertal stage rather than age (Motta-Mena & Scherf, 2017). Intriguingly, there appears to be a paradox between the lower accuracy in identifying fearful facial expressions in childhood, and the early biases to fearful faces found in infancy. While a lower accuracy for fear in identification tasks may sometimes be attributed to its perceptual resemblance with the expression of surprise (Rodger et al., 2015), it appears to persist even when the expression of surprise is not included in the task (e.g., in Székely et al., 2011). This paradox is perhaps

related to the higher accuracy for fear that has been reported in 3-year-old children in a perceptual matching task, as opposed to an identification task (Székely et al., 2011). The mechanism explaining the dissociation is unclear, but early biases and perceptual matching may reflect implicit processing, while identification may reflect explicit recognition. In line with comparable results in adults, neuroimaging studies of emotional facial expressions perception using fMRI or MEG in children have uncovered activation in the amygdala (Herba & Phillips, 2004; Hung, Smith, & Taylor, 2012; Thomas et al., 2001), STS (Lobaugh, Gibson, & Taylor, 2006), ventral medial prefrontal cortex (Wu et al., 2016), and FG (Lobaugh et al., 2006). However, activations in dorsal areas such as the ACC appear to develop later and increase with age in childhood and adolescence (Herba & Phillips, 2004; Hung et al., 2012; Phillips, Drevets, Rauch, & Lane, 2003). Interestingly, neutral faces appear to result in greater amygdala activation than fearful faces in children aged of about 9–13 years as measured with fMRI, while the opposite pattern is found in adults (Thomas et al., 2001). Electrophysiological studies have also revealed subtle differences in facial emotion processing between children and adults. For example, it has been reported that early (e.g., P100) ERP components to facial emotions are sensitive to emotion categories in young children, while face-sensitive components (N170) are not sensitive to emotion categories until 14–15 years (Batty & Taylor, 2006). However, the later could be attributed to higher variability in younger groups. About 40–60% of the variability in ERP responses to emotional faces at age 12 is estimated to be of genetic origin (Anokhin, Golosheykin, & Heath, 2010). MEG studies (Hung et al., 2012) reveal a more complex pattern of results, with early (100–150 ms) amygdala activations to unattended smiling and fearful faces in 7- to 10-year-olds compared to neutral faces, but not in 12- to 15-year-olds who instead show fear specific activations in the ACC at early and 100–150 and 250–280 ms (Hung et al., 2012). The complexity of the functional changes in neural activations underlying the development of facial emotion processing in childhood may explain some of the discrepancies between studies (Hung et al., 2012), perhaps especially when grouping together children based on larger age ranges.

Neural structures involved in social cognition or the processing of social stimuli such as faces (the "social brain," Adolphs, 2009; Frith & Frith, 2007) undergo a second period of profound maturation in adolescence (Blakemore, 2008; Nelson, Leibenluft, McClure, & Pine, 2005). The development of the social brain in puberty and adolescence has been proposed to reflect adolescents' increased sensitivity to sociocultural cues in their environment (Blakemore & Mills, 2014) and increased social interest toward peers rather than caregivers (Nelson et al., 2005; Picci & Scherf, 2016). Neural activations to emotional faces are exaggerated in adolescents as a function of pubertal development across multiple regions including the amygdala, fusiform gyrus, extrastriate cortex, thalami, temporal pole, and ventral prefrontal cortex (Guyer et al., 2008; Killgore & Yurgelun-Todd, 2007; Monk et al., 2003; Moore et al., 2012; Nelson et al., 2003; Passarotti, Sweeney, & Pavuluri, 2009; Swartz, Carrasco, Wiggins, Thomason, & Monk, 2014). In particular, amygdala reactivity to threat-relevant (anger or fear) faces increases in adolescence as a function of hormonal changes associated with puberty (Spielberg et al., 2013; Spielberg, Olino, Forbes, & Dahl, 2014). Functional connectivity between the ACC and the amygdala during emotional face perception also appears to shift from positive to negative during the teenage years (Wu et al., 2016).

Atypical Trajectories and Individual Differences

Here we focus on three distinct categories of atypical developmental trajectories, which uniquely illuminate the developmental mechanisms of facial emotion processing: individual differences based on atypical visual or psychosocial experience or deprivation, autism spectrum disorders, and anxiety disorders.

The development of face processing is a largely experience-expectant and activity-dependent phenomenon (Arcaro, Schade, Vincent, Ponce, & Livingstone, 2017; Nelson, 2003; Pinel et al., 2015). However, the evidence for an effect of atypical visual or emotional experience on the development of facial emotion perception is relatively mixed. As an example, adults who suffered early visual deprivation due to congenital cataracts (Maurer, Lewis, & Mondloch, 2005), and who correspondingly show deficits in invariant face recognition or holistic face processing (Geldart, Mondloch, Maurer, de Schonen, & Brent, 2002; Le Grand & Mondloch, 2004; Le Grand, Mondloch, Maurer, & Brent, 2003), also show differences in similarity judgments of facial emotions but relatively mild deficits in facial emotion identification (Gao et al., 2013). These results suggest that the perception of facial emotion builds on face perception and early visual experience but can be acquired despite persistent difficulties in expert, holistic face processing.

Studies of facial emotion perception in children exposed to adverse socio-emotional experience have confirmed the relative robustness of facial emotion perception abilities as these experiences appear mostly to tweak the categorical boundaries and thresholds for identifying specific emotional facial expressions. As an example, 8- to 10-year-old children exposed to profound early psychosocial deprivation from living in an institution early in life only exhibit slightly higher perceptual thresholds for the identification of smiling expressions (Moulson et al., 2015), with no detectable differences in ERP responses to facial emotions at 12 years of age compared to controls (Young, Luyster, Fox, Zeanah, & Nelson, 2017) despite differences in infancy and toddlerhood (Parker, Nelson, & The Bucarest Early Intervention Project Core Group, 2005).

Children who have experienced physical abuse show lower thresholds for identifying facial expressions of anger and higher thresholds for identifying expressions of fear or sadness mixed with anger (Pollak & Kistler, 2002; Pollak, Messner, Kistler, & Cohn, 2009; Pollak & Sinha, 2002). Children with an experience of neglect, however, do show a more general difficulty in differentiating between different facial emotions (Pollak et al., 2000). Overall, the evidence suggests that different experiences can shape or fine-tune the perceptual learning of emotional faces in development, perhaps depending on which facial emotions are most salient in the child's environment (Pollak et al., 2009). However, the resulting differences in identifying emotional facial expression appear relatively mild compared to other social-emotional domains (Moulson et al., 2015; Young et al., 2017) and may be adaptive in the context of the child's environment: as an example, a superior identification of angry expressions at low intensities may allow chronically abused children to predict, and perhaps avoid, new instances of physical abuse. A first implication of these results is that the amount of experience necessary to acquire functional facial emotion identification abilities could be relatively low. A second implication is that the relatively mild differences in facial emotion identification do not appear likely to underlie the larger difficulties in socio-emotional functioning experienced by many children exposed to deprivation or violence (for a discussion, see, e.g., Young et al., 2017).

Research on face perception abilities or impairments in adults and children with autism spectrum disorders (ASD) have generally been inconsistent due to considerable heterogeneity across participants and tasks (Harms, Martin, & Wallace, 2010). At least two recent meta-analyses however have concluded on the presence of a moderate deficit in facial emotion identification in individuals with ASD compared to the general population (Uljarevic & Hamilton, 2013), which may increase with age as improvements in children with ASD lag behind those of their typically developing (TD) peers (Lozier, Vanmeter, & Marsh, 2014). Interestingly, unaffected siblings of children with ASD are also more likely to show mild impairments in facial emotion perception compared to typically developing children (Oerlemans et al., 2014).

ASD is also associated with differences in sensory perception (Ben-Sasson et al., 2009), physiological reactivity (Bal et al., 2010), face

processing (Weigelt, Koldewyn, & Kanwisher, 2012), social interest and attention to faces (Grelotti, Gauthier, & Schultz, 2002; Osterling & Dawson, 1994), joint attention (Charman, 2003), theory of mind (Frith, 2001), and emotion awareness (Hill, Berthoz, & Frith, 2004), all of which could contribute to development of deficits in facial emotion perception, discrimination, and identification (Nuske, Vivanti, & Dissanayake, 2013). Thus, a first question is whether deficits in facial emotion identification in ASD can be accounted for by a combination of these differences, or if they reflect a distinct impairment specific to ASD (Nuske et al., 2013).

For example, it has been proposed that deficits in facial emotion identification in ASD may be driven by co-morbid alexithymia, suggesting difficulties in interpreting the emotional meaning of facial expressions (Bird & Cook, 2013; Cook, Brewer, Shah, & Bird, 2013; Hill et al., 2004), perhaps in combination with atypical face processing strategies (Wallace, Coleman, & Bailey, 2008). ERP studies have reported atypical, slower responses of reduced amplitudes to emotional faces in children with ASD (Dawson, Webb, Carver, Panagiotides, & McPartland, 2004; Monteiro, Simões, Andrade, & Castelo Branco, 2017). Faster face-related ERP (N290) latencies to neutral faces in the left hemisphere at age 3 years are associated with improvements in autism symptoms as well as lower autism severity in adolescence (Neuhaus et al., 2016). Another study has reported an association between facial emotion identification performance in young adults with ASD and differences in the amplitude of an early visual ERP component (P1) in response to low-intensity emotional faces (Luyster, Bick, Westerlund, & Nelson, 2019). It may be that only subsets of individuals with ASD, perhaps associated with differential genetic variants, show deficits in facial emotion identification (Nuske et al., 2013). Overall, the evidence suggests that there is an impairment of facial emotion identification in autism, but this deficit is not present in all individuals with ASD and could be accounted for by other impairments or comorbidities.

A second question is thus whether training in facial emotion identification generally improves social functioning in individuals with ASD. Recent research has demonstrated the potential of targeted interventions or assistive technology in remediating facial emotion identification in individuals with ASD (e.g., Bauminger, 2002; Kandalaft, Didehbani, Krawczyk, Allen, & Chapman, 2013). These have included behavioral intervention (Bauminger, 2002), computer games or training software (Cockburn et al., 2008; Silver & Oakes, 2001), virtual reality (Georgescu, Kuzmanovic, Roth, Bente, & Vogeley, 2014), and augmented reality (Chen, Lee, & Lin, 2015). Integrated interventions (e.g., Bauminger, 2002) have targeted a range of social cognitive skills with the goal of facilitating real-life functioning, rather than the improvement of facial emotion identification per se. Further research is needed to determine the relative merit of training facial emotion identification specifically, as opposed to other social-emotional skills, in improving real-life social functioning.

Anxiety disorders, social anxiety in particular, are associated with atypical processing of facial emotions in general and negative facial emotions in particular (Binelli et al., 2014; Brühl, Delsignore, Komossa, & Weidt, 2014; Etkin & Wager, 2007; Freitas-Ferrari et al., 2010; Hattingh et al., 2013; Machado-de-Sousa et al., 2010), in line with disrupted attention to threat-relevant cues (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007). For example, facial emotion identification has been found to be moderately impaired in adults (though not necessarily in children) with anxiety (Demenescu, Kortekaas, den Boer, & Aleman, 2010; Easter et al., 2005; McClure, Pope, Hoberman, Pine, & Leibenluft, 2003; Reeb-Sutherland et al., 2015). Perhaps even clearer is the moderate but specific tendency of anxious participants (including children and adults, clinical and nonclinical participants) to exhibit heightened sensitivity to threat-related emotional faces (e.g., increased detection, attention allocation, difficulty disengaging, or avoidance), in dot-probe or similar behavioral tasks compared

to controls (Bar-Haim et al., 2007; Fox, Mathews, Calder, & Yiend, 2007; Georgiou et al., 2005; Mogg, Garner, & Bradley, 2007; Morales, Fu, & Pérez-Edgar, 2016; Puliafico & Kendall, 2006; Roy et al., 2008; Salum et al., 2013; Waters, Mogg, Bradley, & Pine, 2008; Weissman, Chu, Reddy, & Mohlman, 2012).

Such a threat bias is part of a larger pattern of biased emotional processing in individuals with anxiety (Mathews & MacLeod, 2005). Faster latencies or higher amplitudes of ERPs to fearful or angry faces have been found in anxious children and adults compared to non-anxious individuals (Bar-Haim, Lamy, & Glickman, 2005; Eldar, Yankelevitch Roni, Lamy, & Bar-Haim, 2010; Kujawa, MacNamara, Fitzgerald, Monk, & Phan, 2015). These differences are thought to originate from an altered or exaggerated amygdala activity (Bas-Hoogendam et al., 2016; Shin & Liberzon, 2010), and lower activity in regions implicated in attentional control such as the rostral anterior cingulate cortex (Swartz, Phan, et al., 2014). For example, altered reactivity of the amygdala in response to at least some (e.g., fearful, ambiguous or neutral, negative) facial emotions has been reported in adults with social anxiety (Cooney, Atlas, Joormann, Eugène, & Gotlib, 2006), in adults with subclinical tendency toward anxiety (Calder, Ewbank, & Passamonti, 2011; Stein, Simmons, Feinstein, & Paulus, 2007), in adults with social phobia or social anxiety as a function of social anxiety symptoms (Phan, Fitzgerald, Nathan, & Tancer, 2006; Shah, Klumpp, Angstadt, Nathan, & Phan, 2009), in adolescents as a function of anxiety symptoms (Killgore & Yurgelun-Todd, 2005; van den Bulk et al., 2014), or in children with panic or generalized anxiety disorder (Thomas, 2001). Perhaps one of the most consistent findings is the hyperactivation of the amygdala and temporal lobe in response to threatening facial emotions in adults with social anxiety compared to controls (Brühl et al., 2014; Bui et al., 2017; Etkin & Wager, 2007; Freitas-Ferrari et al., 2010; Hattingh et al., 2013; Shah et al., 2009).

Overall, these results suggest that the atypical processing of emotional faces in anxiety disorders reflects more general individual differences in emotional reactivity and negative valence processing (McKay & Tolin, 2017), rather than perceptual differences per se. Thus, the first question is whether individual differences in responses to negative faces may identify individuals at risk for developing anxiety disorders (McKay & Tolin, 2017) and help characterize the neural systems implicated in individual risk for anxiety. Indeed, there is some evidence that heightened responses and attentional bias to threat or emotional faces are present in children at risk for anxiety disorders because of temperament (Fox, Henderson, Marshall, Nichols, & Ghera, 2005; Kagan, Reznick, & Snidman, 1988; Morgan, 2006; Thai, Taber-Thomas, & Pérez-Edgar, 2016), or exposure to maternal or direct stress or trauma (de Haan et al., 2004; Otte et al., 2015; Pine et al., 2005; Taylor-Colls & Pasco Fearon, 2015). A developmental approach is particularly relevant to this endeavor, as anxiety disorders emerge in childhood and adolescence (Beesdo, Knappe, & Pine, 2009) and early emotional regulation difficulties in preschoolers predict later anxiety in childhood (Bosquet & Egeland, 2006).

Animal models suggest that genetic dispositions and stressors occurring during developmental windows of vulnerability may prime individuals to develop anxiety or depressive disorders later in life (Leonardo & Hen, 2008). In the context of facial emotion processing, it is interesting to note that a large-scale study (N = 338) of preschoolers with a longitudinal follow-up after 6 months found that shyness and anxiety scores predicted lower emotional faces identification at the first time-point, but also less improvement in emotional faces identification between the two time points, marking a developmental effect of anxiety on facial emotion identification (Strand, Cerna, & Downs, 2008).

Conversely, it has been proposed that attentional biases toward threat and negative emotions in young children may reflect individual (e.g., genetic) risk profiles for the development of anxiety disorders and could act as maintaining factors in anxiety (Eldar, Ricon, & Bar-Haim, 2008). This is especially compelling because attentional

biases to threat and negative facial emotions are evident from infancy (Leppänen & Nelson, 2009; LoBue & Rakison, 2013) and thus could be leveraged to predict anxiety risk from an early age, perhaps in association with other risk factors such as low effortful-control or other aspects of temperament and executive function (Helzer, Connor-Smith, & Reed, 2009; Lonigan, Vasey, Phillips, & Hazen, 2004; Morales et al., 2016; Puliafico & Kendall, 2006). For example, behavioral attentional biases toward fearful faces at 12 months were found to be associated with negative affect at this same age, although they were not significantly related to negative affect at later time points (Nakagawa & Sukigara, 2012).

A second question is whether individual differences in responses to negative faces may differentiate between closely related clinical profiles and perhaps predict treatment responses (for a review on neurobiological markers of treatment outcomes in anxiety disorders, including neural responses to emotional faces, see, e.g., Lueken et al., 2016). For example, one fMRI study in adults reported differential patterns of responses to fearful versus angry faces in adults with social phobia versus generalized anxiety (Blair et al., 2008). Another study reported a positive relationship between treatment efficacy and pretreatment amygdala response during a series of facial emotion processing tasks in adolescents with generalized anxiety (McClure et al., 2007; see also Burkhouse et al., 2017). These are very promising results, but a limitation of this approach is that because of its high cost, fMRI is probably not a realistically scalable method for routine clinical assessments. Behavioral metrics, or cheaper neural methods including EEG or fNIRS, could circumvent this issue. However, none of these methods can provide a direct assessment of the reactivity of the amygdala or other limbic and subcortical structures implicated in anxiety and risk for anxiety (but see Bunford, Kujawa, Fitzgerald, Monk, & Phan, 2018). It is encouraging to note that despite this important limitation, at least one EEG study in children with anxiety disorders has reported a relation between treatment efficacy and pretreatment EEG responses during an emotional face processing task (Bunford et al., 2017). Another study using EEG demonstrated increased neural responses to fearful faces in adults with social anxiety restricted to performance situations (McTeague et al., 2018).

On the one hand, differences in facial emotion identification in children and adults with atypical early visual or psychosocial experience have confirmed the relative robustness of facial emotion identification to differential experience, although both visual and psychosocial experience subtly shape this faculty. For example, early visual deprivation affects face recognition more profoundly than facial emotion identification, in accordance with the dissociation of these two abilities. On the other hand, differences in facial emotion processing in children and adults with anxiety or autism spectrum disorders reveal the role of emotion understanding, emotional attention, and attentional regulation, in shaping individual differences in facial emotion processing.

Outstanding Questions

Perceived Emotional Valence of Facial Expressions in Development

Behavioral and neuroimaging studies in infants and very young children have mostly focused on the ability to differentiate between, or differentially respond to, different facial emotions. However, a different question is the degree to which infants and very young children may extract the specific emotional content of these expressions. For example, studies in infants have demonstrated attentional biases toward some negative valence (fear, anger) expressions. However, it is unclear whether infants subjectively experience these faces as emotionally negative. Similarly, very young infants typically attend to smiling faces preferentially, but it is not entirely clear whether they experience these faces as particularly rewarding or simply as familiar.

An approach consists in drawing from the circumplex model of affect in adults (Russell, 1980), i.e., the organization of affects according to the dimensions of valence in addition to

arousal, to ask whether children can extract the valence of facial emotions and how the representational space of facial emotions develops over time (Russell & Bullock, 1985, 1986). This line of inquiry has led to interesting insights. Most strikingly, children as young as 2 years appear to spontaneously organize facial emotions along a two-dimensional space that roughly corresponds to the dimensions of valence and arousal (Russell & Bullock, 1985, 1986). However, the children's labeling of facial expressions has suggested that they may only gradually learn to differentiate among different negative expressions (Russell & Widen, 2002; Widen, 2013; Widen & Russell, 2003, 2008). More recent approaches in adults have proposed additional dimensions to inferred emotional experience (e.g., certainty, morality, safety) that more closely account for neural responses, i.e., an appraisal space that comprises more dimensions than valence and arousal (Skerry & Saxe, 2015). Because the dimensions of this proposed appraisal space (Skerry & Saxe, 2015) have varying degrees of abstraction (e.g., others' knowledge, distant past; versus expectedness, pleasantness), it would be interesting to see how social experience, cognitive, and theory of mind development affect the dimensions of perceived emotions across development in early childhood.

The attribution of valence to facial expressions of emotions by preverbal participants is more difficult to study, due to limitations in infants' behavioral repertoire. For example, 7-month-old infants do not appear to discriminate negative from positive facial emotions, although 10-month-olds show signs of doing so (Ludemann, 1991). Because infants cannot provide verbal reports of their own experience of emotions, it is thus tempting to turn to reverse inference for clues to the perceived emotional valence of facial emotions in infants (but see, e.g., Anderson & Adolphs, 2014, for an alternative approach in nonverbal animals that does not rely on subjective reports or reverse inference). For example, neuroimaging results (Goksan et al., 2015) have been used to infer the nature of the experience of pain in newborns. In the same vein, one may infer from the orbitofrontal activation observed in infants watching videos of their own mothers' smiling that they attribute a particularly positive valence to these smiles (Minagawa-Kawai et al., 2009). However, this approach is generally limited by at least two factors.

One limitation concerns the relative inaccessibility of many cortical and subcortical (e.g., the amygdala) regions involved in emotion processing by usual methods of neuroimaging in awake infants (EEG and fNIRS; but see, e.g., Deen et al., 2017; Tzourio-Mazoyer et al., 2002; Weaver, 2015). These areas may also undergo significant functional changes over development, which limits the validity of reverse inferences comparing the localization of neural activity in infants and adults or even children. A second limitation concerns the complex nature of emotion and valence attribution. With the exception of a few candidate areas (e.g., the ventral medial prefrontal cortex and positive valence; Lindquist, Satpute, Wager, Weber, & Barrett, 2016), there are no areas of the brain whose isolated activity clearly and reliably distinguishes emotions or even valence (as opposed to co-activation patterns or single-neuron activity, e.g., see Lindquist et al., 2016; Lindquist, Wager, Kober, Bliss-Moreau, & Barrett, 2012; Namburi et al., 2015; Wager et al., 2015): emotion pervades subjective experience. A similar argument can be made from the field of linguistics, as very few languages have grammatical structures dedicated to the expression of affects only. Instead, the expression of affects often parsimoniously borrows from existing grammatical structures such as those used for the expression of action, possession, or being acted upon (Hagège, 2006). Thus, it seems unlikely that an unambiguous marker of valence, let alone specific emotions, may be reverse inferred from neural measures. Overt behavior provides an additional set of cues. For example, contraction of the facial muscle corrugator supercilii has been used as a nonverbal indicator of negative valence in newborns (Trapanotto et al., 2004). Conversely, it is striking that 7-month-old infants differentiate between several facial expressions of emotion and exhibit an

attentional bias to the expression of fear, yet do not show any behavioral sign of distress to negative facial emotions such as angry or fearful faces. This suggests that infants may not experience these faces as negative in valence. Another behavioral indicator of valence attribution by infants comes from the information that infants appear to extract from facial expressions: for example, the association of smiling with achieving a goal (Skerry & Spelke, 2014), or liking a specific object (Pauen et al., 2015; Phillips et al., 2002). While such approach does not require verbal reports, it remains constrained by infants' cognitive and behavioral limitations. Despite these challenges, and independently of the experienced valence of facial emotions by infants, perhaps the association of genetic variants or dimensions of attachment and temperament with infants' neural or behavioral responses to negative and positive facial emotions (Forssman et al., 2014; Grossmann et al., 2011; Peltola et al., 2015) can provide the most compelling evidence for a developmental continuity of positive and negative valence processing systems from infancy. For example, increasing numbers of stressful life events currently affecting infant's mothers are associated with larger attentional biases to fear as measured behaviorally (Forssman et al., 2014), suggesting that even at this early age, attentional biases to fear faces might be driven by or reflect emotional functioning. A converging argument for the relative continuity of emotional experience from infancy to early childhood might be made from the relative developmental stability of functional networks involving the amygdala during this period (Gabard-Durnam et al., 2018). Future longitudinal work linking early measures of facial emotion processing to multiple markers of emotional functioning or understanding, possibly longitudinally and across multiple types of facial emotions, will help establishing the emotional quality of early facial emotion processing and its relevance to emotional functioning.

Commonalities and Variations in Facial Emotion Identification Across Cultures

There is a universal propensity to perceive emotions expressed through facial movements. Early cross-cultural work on facial emotion perception has often emphasized this pan-cultural aspect by advancing the notion that a small, shared, core set of "basic" facial emotions are universally identified and produced in a similar fashion across cultures (Ekman, 1980; Ekman & Friesen, 1971; Ekman, Sorenson, & Friesen, 1969). More recent research, however, has begun to uncover fascinating cultural variations in the perception of facial expressions of emotion (Barrett, Lindquist, & Gendron, 2007; Chen & Jack, 2017; Gendron, 2017; Gendron, Roberson, van der Vyver, & Barrett, 2014; Nelson & Russell, 2013).

As an example, Eastern and Western observers differ in their responses when labeling random facial expressions displayed on artificial faces (Jack, Garrod, Yu, Caldara, & Schyns, 2012; Jack, Sun, Delis, Garrod, & Schyns, 2016) and in their scanning patterns to emotional faces (Jack, Blais, Scheepers, Schyns, & Caldara, 2009). Such differences in scanning patterns to emotional faces between Eastern and Western observers can be found in infants as early as 7 months of age (Geangu et al., 2016). Perhaps even more striking is the interpretation and usage of the wide-eyed, gasping "fear" face with direct gaze as an expression of anger and interpersonal threat in some cultures, as demonstrated by a study of facial emotion perception in adolescents from the Trobriand Islands in Papua New Guinea (Crivelli, Russell, Jarillo, & Fernández-Dols, 2016). Smiles, in contrast, were readily identified by these participants (Crivelli et al., 2016). This suggests an intriguing possibility that the attention-grabbing, canonical "fear" face may be universally perceived as indicative of a threat but that its specific interpretation (perceived threat versus threatening display) varies across cultures. This could potentially explain the relative lag in the explicit understanding of fearful (versus

angry) faces in young children, despite early biases toward this expression. Alternatively, the "fear" face may have been "culturally recycled" for their attention-grabbing property, acquiring a new meaning in Trobriander culture through cultural evolution. While the relative degree to which facial emotion perception varies across cultures remains controversial (Sauter & Eisner, 2013), these converging results open a new area of investigation to uncover how and why specific facial expressions acquire new, cultural meanings in development and over cultural time, while others (such as the smile) may be identified universally and relatively early in development (Chen & Jack, 2017; Gendron, 2017; Nelson & Russell, 2013). Insights and methods from the quantitative, psychological science of culture, language, and cultural evolution (Barrett et al., 2007; Greenfield, 2013; Michel et al., 2011; ojalehto & Medin, 2015) may prove instrumental in tackling such problems in future work.

Conclusion

The ability to perceive, discriminate, and identify emotional facial expressions appears remarkably robust. Yet, the cultural usage and fine-grained interpretation of emotional facial expressions exhibit exquisite variations. The perception of facial emotion develops in a nonlinear fashion, with critical aspects coming on line around the age of 7 months, followed by a more protracted emergence of contextual understanding and a refinement of emotional labels over late infancy and childhood, with additional improvements in interpreting more complex facial emotions occurring in adolescence. The perception of smiling is notable by its developmental precedence and possible universality. Fearful faces remarkably evoke increased attentional and perceptual responses in infancy, with implications for understanding the neural circuits underlying individual liability for anxiety as fearful or angry faces have proven useful to probe individual differences in attention to threat. Fearful expressions are paradoxically hard to identify for young children, perhaps due to their higher cognitive difficulty and lower familiarity. Future research may help clarifying the cognitive and neural processes involved in interpreting, rather than perceiving or discriminating, facial emotions, which could help specify and disentangle the mechanisms by which differences in culture, emotion understanding abilities, or experience, differentially affect this ability.

Acknowledgments This work was supported by the National Institutes of Health (MH078829) to C.A.N. and Michelle Bosquet Enlow and a Philippe Foundation grant to L.B.

References

Adolphs, R. (2009). The social brain: Neural basis of social knowledge. *Annual Review of Psychology, 60*, 693–716. https://doi.org/10.1146/annurev.psych.60.110707.163514

Adolphs, R., Damasio, H., Tranel, D., & Damasio, A. R. (1996). Cortical systems for the recognition of emotion in facial expressions. *Journal of Neuroscience, 16*, 7678–7687.

Ahs, F., Davis, F. C., Gorka, A. X., & Hariri, A. R. (2014). Feature-based representations of emotional facial expressions in the human amygdala. *Social Cognitive and Affective Neuroscience, 9*, 1372–1378. https://doi.org/10.1093/scan/nst112

Anderson, D. J., & Adolphs, R. (2014). A framework for studying emotions across species. *Cell, 157*, 187–200. https://doi.org/10.1016/j.cell.2014.03.003

Anokhin, A. P., Golosheykin, S., & Heath, A. C. (2010). Heritability of individual differences in cortical processing of facial affect. *Behavior Genetics, 40*, 178–185. https://doi.org/10.1007/s10519-010-9337-1

Arcaro, M. J., Schade, P. F., Vincent, J. L., Ponce, C. R., & Livingstone, M. S. (2017). Seeing faces is necessary for face-domain formation. *Nature Neuroscience, 20*, 1404–1412. https://doi.org/10.1038/nn.4635

Bal, E., Harden, E., Lamb, D., Van Hecke, A. V., Denver, J. W., & Porges, S. W. (2010). Emotion recognition in children with autism spectrum disorders: Relations to eye gaze and autonomic state. *Journal of Autism and Developmental Disorders, 40*, 358–370. https://doi.org/10.1007/s10803-009-0884-3

Bar-Haim, Y., Lamy, D., & Glickman, S. (2005). Attentional bias in anxiety: A behavioral and ERP study. *Brain and Cognition, 59*, 11–22. https://doi.org/10.1016/j.bandc.2005.03.005

Bar-Haim, Y., Lamy, D., Pergamin, L., Bakermans-Kranenburg, M. J., & van IJzendoorn, M. H. (2007). Threat-related attentional bias in anxious and nonanxious individuals: A meta-analytic study.

Psychological Bulletin, 133, 1–24. https://doi.org/10.1037/0033-2909.133.1.1

Barrett, L. F., Lindquist, K. A., & Gendron, M. (2007). Language as context for the perception of emotion. *Trends in Cognitive Sciences, 11*, 327–332. https://doi.org/10.1016/j.tics.2007.06.003

Barrett, L. F., Mesquita, B., & Gendron, M. (2011). Context in emotion perception. *Current Directions in Psychological Science, 20*, 286–290. https://doi.org/10.1177/0963721411422522

Bas-Hoogendam, J. M., Blackford, J. U., Brühl, A. B., Blair, K. S., van der Wee, N. J. A., & Westenberg, P. M. (2016). Neurobiological candidate endophenotypes of social anxiety disorder. *Neuroscience and Biobehavioral Reviews, 71*, 362–378. https://doi.org/10.1016/j.neubiorev.2016.08.040

Bate, S., Cook, S. J., Mole, J., & Cole, J. (2013). First report of generalized face processing difficulties in Moebius sequence. *PLoS One, 8*, e62656. https://doi.org/10.1371/journal.pone.0062656

Batty, M., & Taylor, M. J. (2003). Early processing of the six basic facial emotional expressions. *Cognitive Brain Research, 17*, 613–620. https://doi.org/10.1016/S0926-6410(03)00174-5

Batty, M., & Taylor, M. J. (2006). The development of emotional face processing during childhood. *Developmental Science, 9*, 207–220. https://doi.org/10.1111/j.1467-7687.2006.00480.x

Baudouin, J.-Y., Gilibert, D., Sansone, S., & Tiberghien, G. (2000). When the smile is a cue to familiarity. *Memory, 8*, 285–292. https://doi.org/10.1080/09658210050117717

Bauminger, N. (2002). The facilitation of social-emotional understanding and social interaction in high-functioning children with autism: Intervention outcomes. *Journal of Autism and Developmental Disorders, 32*, 283–298. https://doi.org/10.1023/A:1016378718278

Bayet, L., Pascalis, O., Quinn, P. C., Lee, K., Gentaz, É., & Tanaka, J. W. (2015). Angry facial expressions bias gender categorization in children and adults: Behavioral and computational evidence. *Frontiers in Psychology, 6*, 346. https://doi.org/10.3389/fpsyg.2015.00346

Bayet, L., Quinn, P. C., Laboissière, R., Caldara, R., Lee, K., & Pascalis, O. (2017). Fearful but not happy expressions boost face detection in human infants. *Proceedings of the Royal Society B: Biological Sciences, 284*, 20171054. https://doi.org/10.1098/rspb.2017.1054

Bayet, L., Quinn, P. C., Tanaka, J. W., Lee, K., Gentaz, É., & Pascalis, O. (2015). Face gender influences the looking preference for smiling expressions in 3.5-month-old human infants. *PLoS One, 10*, e0129812. https://doi.org/10.1371/journal.pone.0129812

Beesdo, K., Knappe, S., & Pine, D. S. (2009). Anxiety and anxiety disorders in children and adolescents: Developmental issues and implications for DSM-V. *Psychiatric Clinics of North America, 32*, 483–524. https://doi.org/10.1016/j.psc.2009.06.002

Ben-Sasson, A., Hen, L., Fluss, R., Cermak, S. A., Engel-Yeger, B., & Gal, E. (2009). A meta-analysis of sensory modulation symptoms in individuals with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 39*, 1–11. https://doi.org/10.1007/s10803-008-0593-3

Biagi, L., Crespi, S. A., Tosetti, M., & Morrone, M. C. (2015). BOLD response selective to flow-motion in very young infants. *PLoS Biology, 13*(9), 1–22. https://doi.org/10.1371/journal.pbio.1002260

Binelli, C., Subirà, S., Batalla, A., Muñiz, A., Sugranyés, G., Crippa, J. A., … Martín-Santos, R. (2014). Common and distinct neural correlates of facial emotion processing in social anxiety disorder and Williams syndrome: A systematic review and voxel-based meta-analysis of functional resonance imaging studies. *Neuropsychologia, 64*, 205–217. https://doi.org/10.1016/j.neuropsychologia.2014.08.027

Bird, G., & Cook, R. (2013). Mixed emotions: The contribution of alexithymia to the emotional symptoms of autism. *Translational Psychiatry, 3*, e285. https://doi.org/10.1038/tp.2013.61

Blair, K., Shaywitz, J., Smith, B. W., Rhodes, R., Geraci, M., Jones, M., … Pine, D. S. (2008). Response to emotional expressions in generalized social phobia and generalized anxiety disorder: Evidence for separate disorders. *American Journal of Psychiatry, 165*, 1193–1202. https://doi.org/10.1176/appi.ajp.2008.07071060

Blakemore, S.-J. (2008). The social brain in adolescence. *Nature Reviews Neuroscience, 9*, 267–277. https://doi.org/10.1038/nrn2353

Blakemore, S.-J., & Mills, K. L. (2014). Is adolescence a sensitive period for sociocultural processing? *Annual Review of Psychology, 65*(1), 187–207. https://doi.org/10.1146/annurev-psych-010213-115202

Blasi, A., Mercure, E., Lloyd-Fox, S., Thomson, A., Brammer, M., Sauter, D., … Murphy, D. G. M. (2011). Early specialization for voice and emotion processing in the infant brain. *Current Biology, 21*, 1220–1224. https://doi.org/10.1016/j.cub.2011.06.009

Bogart, K., Matsumoto, D., & Bogart, K. (2010). Facial mimicry is not necessary to recognize emotion: Facial expression recognition by people with Moebius syndrome. *Social Neuroscience, 5*, 241–251. https://doi.org/10.1080/17470910903395692

Bornstein, M. H., & Arterberry, M. E. (2003). Recognition, discrimination and categorization of smiling by 5-month-old infants. *Developmental Science, 6*, 585–599. https://doi.org/10.1111/1467-7687.00314

Bornstein, M. H., Arterberry, M. E., Mash, C., & Manian, N. (2011). Discrimination of facial expression by 5-month-old infants of nondepressed and clinically depressed mothers. *Infant Behavior and Development, 34*, 100–106. https://doi.org/10.1016/j.infbeh.2010.10.002.Discrimination

Bornstein, M. H., Mash, C., Arterberry, M. E., & Manian, N. (2012). Object perception in 5-month-old infants of clinically depressed and non-depressed mothers. *Infant Behavior and Development, 35*, 150–157.

https://doi.org/10.1016/j.biotechadv.2011.08.021. Secreted

Bosquet, M., & Egeland, B. (2006). The development and maintenance of anxiety symptoms from infancy through adolescence in a longitudinal sample. *Development and Psychopathology, 18*, 517–550. https://doi.org/10.1017/S0954579406060275

Brennan, A. M., Harris, A. W. F., & Williams, L. M. (2014). Neural processing of facial expressions of emotion in first onset psychosis. *Psychiatry Research, 219*, 477–485.

Bruce, V., & Young, A. W. (1986). Understanding face recognition. *British Journal of Psychology, 77*, 305–327. https://doi.org/10.1111/j.2044-8295.1986.tb02199.x/full

Brühl, A. B., Delsignore, A., Komossa, K., & Weidt, S. (2014). Neuroimaging in social anxiety disorder-A meta-analytic review resulting in a new neurofunctional model. *Neuroscience and Biobehavioral Reviews, 47*, 260–280. https://doi.org/10.1016/j.neubiorev.2014.08.003

Bui, E., Anderson, E., Goetter, E. M., Campbell, A. A., Fischer, L. E., Barrett, L. F., & Simon, N. M. (2017). Heightened sensitivity to emotional expressions in generalised anxiety disorder, compared to social anxiety disorder, and controls. *Cognition and Emotion, 31*, 119–126. https://doi.org/10.1080/02699931.2015.1087973

Bunford, N., Kujawa, A., Fitzgerald, K. D., Monk, C. S., & Phan, K. L. (2018). Convergence of BOLD and ERP measures of neural reactivity to emotional faces in children and adolescents with and without anxiety disorders. *Biological Psychology, 134*, 9–19. https://doi.org/10.1016/j.biopsycho.2018.02.006

Bunford, N., Kujawa, A., Fitzgerald, K. D., Swain, J. E., Hanna, G. L., Koschmann, E., … Phan, K. L. (2017). Neural reactivity to angry faces predicts treatment response in pediatric anxiety. *Journal of Abnormal Child Psychology, 45*, 385–395. https://doi.org/10.1007/s10802-016-0168-2

Burkhouse, K. L., Kujawa, A., Klumpp, H., Fitzgerald, K. D., Monk, C. S., & Phan, K. L. (2017). Neural correlates of explicit and implicit emotion processing in relation to treatment response in pediatric anxiety. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 58*, 546–554. https://doi.org/10.1111/jcpp.12658

Burton, A. M., Bruce, V., & Dench, N. (1993). What's the difference between men and women? Evidence from facial measurement. *Perception, 22*, 153.

Calder, A. J., Ewbank, M., & Passamonti, L. (2011). Personality influences the neural responses to viewing facial expressions of emotion. *Philosophical Transactions of the Royal Society B: Biological Sciences, 366*, 1684–1701. https://doi.org/10.1098/rstb.2010.0362

Calder, A. J., Keane, J., Cole, J., Campbell, R., & Young, A. W. (2000). Facial expression recognition by people with Moebius syndrome. *Cognitive Neuropsychology, 17*, 73–87. https://doi.org/10.1080/026432900380490

Calder, A. J., & Young, A. W. (2005). Understanding the recognition of facial identity and facial expression. *Nature Reviews Neuroscience, 6*, 641–651. https://doi.org/10.1038/nrn1724

Camras, L. a., & Allison, K. (1985). Children's understanding of emotional facial expressions and verbal labels. *Journal of Nonverbal Behavior, 9*, 84–94. https://doi.org/10.1007/BF00987140

Caron, A. J., Caron, R. F., Maclean, D. J., & Url, S. (1988). Infant discrimination of naturalistic emotional expressions: The role of face and voice. *Child Development, 59*, 604–616.

Caron, R. F., Caron, A. J., & Myers, R. S. (1982). Abstraction of invariant face expressions. *Child Development, 53*, 1008.

Caron, R. F., Caron, A. J., & Myers, R. S. (1985). Do infants see emotional expressions in static faces? *Child Development, 56*, 1552–1560.

Charman, T. (2003). Why is joint attention a pivotal skill in autism? *Philosophical Transactions of the Royal Society B: Biological Sciences, 358*, 315–324. https://doi.org/10.1098/rstb.2002.1199

Chen, C., & Jack, R. E. (2017). Discovering cultural differences (and similarities) in facial expressions of emotion. *Current Opinion in Psychology, 17*, 61–66. https://doi.org/10.1016/j.copsyc.2017.06.010

Chen, C.-H., Lee, I.-J., & Lin, L.-Y. (2015). Augmented reality-based self-facial modeling to promote the emotional expression and social skills of adolescents with autism spectrum disorders. *Research in Developmental Disabilities, 36*, 396–403. https://doi.org/10.1016/j.ridd.2014.10.015

Chronaki, G., Hadwin, J. a., Garner, M., Maurage, P., & Sonuga-Barke, E. J. S. (2015). The development of emotion recognition from facial expressions and non-linguistic vocalizations during childhood. *British Journal of Developmental Psychology, 33*, 218–236. https://doi.org/10.1111/bjdp.12075

Cockburn, J., Bartlett, M., Tanaka, J., Movellan, J., Pierce, M., & Schultz, R. (2008). SmileMaze: A tutoring system in real-time facial expression perception and production in children with autism spectrum disorder. In Proceedings of IEEE International Conference on Automatic Face & Gesture Recognition, Amsterdam, The Netherlands, 17–19 September 2008; pp. 978–986.

Conty, L., Dezecache, G., Hugueville, L., & Grezes, J. (2012). Early binding of gaze, gesture, and emotion: Neural time course and correlates. *Journal of Neuroscience, 32*, 4531–4539. https://doi.org/10.1523/JNEUROSCI.5636-11.2012

Cook, R., Brewer, R., Shah, P., & Bird, G. (2013). Alexithymia, not autism, predicts poor recognition of emotional facial expressions. *Psychological Science, 24*, 723–732. https://doi.org/10.1177/0956797612463582

Cooney, R. E., Atlas, L. Y., Joormann, J., Eugène, F., & Gotlib, I. H. (2006). Amygdala activation in the processing of neutral faces in social anxiety disorder: Is neutral really neutral? *Psychiatry Research* –

Neuroimaging, 148, 55–59. https://doi.org/10.1016/j.pscychresns.2006.05.003

Coulon, M., Hemimou, C., & Streri, A. (2013). Effects of seeing and hearing vowels on neonatal facial imitation. *Infancy, 18*, 782–796. https://doi.org/10.1111/infa.12001

Crivelli, C., Russell, J. A., Jarillo, S., & Fernández-Dols, J.-M. (2016). The fear gasping face as a threat display in a Melanesian society. *Proceedings of the National Academy of Sciences, 113*, 12403–12407. https://doi.org/10.1073/pnas.1611622113

Darwin, C. (1872). *The expression of the emotions in man and animals*. London, UK: John Murray.

Dawson, G., Webb, S. J., Carver, L., Panagiotides, H., & McPartland, J. (2004). Young children with autism show atypical brain responses to fearful versus neutral facial expressions of emotion. *Developmental Science, 7*, 340–359. https://doi.org/10.1111/j.1467-7687.2004.00352.x

Dawson, G., Webb, S. J., & McPartland, J. (2005). Understanding the nature of face processing impairment in autism: Insights from behavioral and electrophysiological studies. *Developmental Neuropsychology, 27*, 403–424. https://doi.org/10.1207/s15326942dn2703_6

de Gelder, B., van Honk, J., & Tamietto, M. (2011). Emotion in the brain: Of low roads, high roads and roads less travelled. *Nature Reviews Neuroscience, 12*, 425. https://doi.org/10.1038/nrn2920-c1

de Haan, M., Belsky, J., Reid, V., Volein, A., & Johnson, M. H. (2004). Maternal personality and infants' neural and visual responsivity to facial expressions of emotion. *Journal of Child Psychology and Psychiatry, 45*, 1209–1218. https://doi.org/10.1111/j.1469-7610.2004.00320.x

Deen, B., Richardson, H., Dilks, D. D., Takahashi, A., Keil, B., Wald, L. L., … Saxe, R. R. (2017). Organization of high-level visual cortex in human infants. *Nature Communications, 8*, 13995. https://doi.org/10.1038/ncomms13995

Deffke, I., Sander, T., Heidenreich, J., Sommer, W., Curio, G., Trahms, L., & Lueschow, A. (2007). MEG/EEG sources of the 170-ms response to faces are co-localized in the fusiform gyrus. *NeuroImage, 35*, 1495–1501. https://doi.org/10.1016/j.neuroimage.2007.01.034

DeLoache, J. S., & LoBue, V. (2009). The narrow fellow in the grass: Human infants associate snakes and fear. *Developmental Science, 12*, 201–207. https://doi.org/10.1111/j.1467-7687.2008.00753.x

Demenescu, L. R., Kortekaas, R., den Boer, J. A., & Aleman, A. (2010). Impaired attribution of emotion to facial expressions in anxiety and major depression. *PLoS One, 5*(12), e15058. https://doi.org/10.1371/journal.pone.0015058

Dobkins, K., & Harms, R. (2014). The face inversion effect in infants is driven by high, and not low, spatial frequencies. *Journal of Vision, 14*, 1–17. https://doi.org/10.1167/14.1.1.doi

Duchenne, G. (1862). *Mécanisme de la physionomie humaine*.

Dumas, T., Dubal, S., Attal, Y., Chupin, M., Jouvent, R., Morel, S., & George, N. (2013). MEG evidence for dynamic amygdala modulations by gaze and facial emotions. *PLoS One, 8*, e74145. https://doi.org/10.1371/journal.pone.0074145

Dunham, Y., Chen, E. E., & Banaji, M. R. (2013). Two signatures of implicit intergroup attitudes: Developmental invariance and early enculturation. *Psychological Science, 24*, 860–868. https://doi.org/10.1177/0956797612463081

Durand, K., Gallay, M., Seigneuric, A., Robichon, F., & Baudouin, J.-Y. (2007). The development of facial emotion recognition: The role of configural information. *Journal of Experimental Child Psychology, 97*, 14–27. https://doi.org/10.1016/j.jecp.2006.12.001

Easter, J., McClure, E. B., Monk, C. S., Dhanani, M., Hodgdon, H., Leibenluft, E., … Ernst, M. (2005). Emotion recognition deficits in pediatric anxiety disorders: Implications for amygdala research. *Journal of Child and Adolescent Psychopharmacology, 15*, 563–570. https://doi.org/10.1089/cap.2005.15.563

Eimer, M., & Holmes, A. (2007). Event-related brain potential correlates of emotional face processing. *Neuropsychologia, 45*, 15–31. https://doi.org/10.1016/j.neuropsychologia.2006.04.022

Ekman, P. (1980). *The face of man: Expressions of universal emotions in a New Guinea village*. New York, NY: Garland STPM Press.

Ekman, P., & Friesen, W. V. (1971). Constants across cultures in the face and emotion. *Journal of Personality and Social Psychology, 17*, 124.

Ekman, P., Sorenson, E. R., & Friesen, W. V. (1969). Pan-cultural elements in facial displays of emotion. *Science, 164*, 86–88.

Eldar, S., Ricon, T., & Bar-Haim, Y. (2008). Plasticity in attention: Implications for stress response in children. *Behaviour Research and Therapy, 46*, 450–461. https://doi.org/10.1016/j.brat.2008.01.012

Eldar, S., Yankelevitch Roni, R., Lamy, D., & Bar-Haim, Y. (2010). Enhanced neural reactivity and selective attention to threat in anxiety. *Biological Psychology, 85*, 252–257. https://doi.org/10.1016/j.biopsycho.2010.07.010

Etkin, A., & Wager, T. D. (2007). Functional neuroimaging of anxiety: A meta-ana lysis of emotional processing in PTSD, social anxiety disorder, and specific phobia. *American Journal of Psychiatry, 164*, 1476–1488. https://doi.org/10.1176/appi.ajp.2007.07030504

Farroni, T., Menon, E., Rigato, S., & Johnson, M. H. (2007). The perception of facial expressions in newborns. *European Journal of Developmental Psychology, 4*, 2–13. https://doi.org/10.1080/17405620601046832

Feinman, S. (1982). Social referencing in infancy. *Merrill-Palmer Quarterly: Journal of Developmental Psychology, 28*, 445–470.

Field, T. M., Woodson, R., Greenberg, R., & Cohen, D. (1982). Discrimination and imitation of facial expressions by neonates. *Science, 218*, 179–181.

Fiset, D., Blais, C., Royer, J., Richoz, A.-R., Dugas, G., & Caldara, R. (2017). Mapping the impairment in decoding static facial expressions of emotion in prosopagnosia. *Social Cognitive and Affective Neuroscience, 12*(8), 1334–1341. https://doi.org/10.1093/scan/nsx068

Flom, R., & Bahrick, L. E. (2007). The development of infant discrimination of affect in multimodal and unimodal stimulation: The role of intersensory redundancy. *Developmental Psychology, 43*, 238–252. https://doi.org/10.1037/0012-1649.43.1.238

Forssman, L., Peltola, M. J., Yrttiaho, S., Puura, K., Mononen, N., Lehtimäki, T., & Leppänen, J. M. (2014). Regulatory variant of the TPH2 gene and early life stress are associated with heightened attention to social signals of fear in infants. *Journal of Child Psychology and Psychiatry, 55*, 793–801. https://doi.org/10.1111/jcpp.12181

Fox, E., Mathews, A., Calder, A. J., & Yiend, J. (2007). Anxiety and sensitivity to gaze direction in emotionally expressive faces. *Emotion, 7*, 478–486. https://doi.org/10.1037/1528-3542.7.3.478

Fox, N. A., Henderson, H. A., Marshall, P. J., Nichols, K. E., & Ghera, M. M. (2005). Behavioral inhibition: Linking biology and behavior within a developmental framework. *Annual Review of Psychology, 56*, 235–262. https://doi.org/10.1146/annurev.psych.55.090902.141532

Freitas-Ferrari, M. C., Hallak, J. E. C., Trzesniak, C., Filho, A. S., Machado-de-Sousa, J. P., Chagas, M. H. N., … Crippa, J. A. S. (2010). Neuroimaging in social anxiety disorder: A systematic review of the literature. *Progress in Neuro-Psychopharmacology and Biological Psychiatry, 34*, 565–580. https://doi.org/10.1016/j.pnpbp.2010.02.028

Frith, C. D., & Frith, U. (2007). Social cognition in humans. *Current Biology, 17*(16), R724–R732. https://doi.org/10.1016/j.cub.2007.05.068

Frith, U. (2001). Mind blindness and the brain in autism. *Neuron, 32*(6), 969–979.

Fusar-Poli, P., Placentino, A., Carletti, F., Landi, P., Allen, P., Surguladze, S., … Politi, P. (2009). Functional atlas of emotional faces processing: A voxel-based meta-analysis of 105 functional magnetic resonance imaging studies. *Journal of Psychiatry and Neuroscience, 34*, 418–432. https://doi.org/10.1016/S1180-4882(09)50077-7

Gabard-Durnam, L. J., O'Muircheartaigh, J., Dirks, H., Dean III, D. C., Tottenham, N., & Deoni, S. (2018). Humanamygdala functional network development: a cross-sectional study from 3 months to 5 years of age. *Developmental cognitive neuroscience, 34*, 63–74.

Galati, D., Sini, B., Schmidt, S., & Tinti, C. (2003). Spontaneous facial expressions in congenitally blind and sighted children aged 8–11. *Journal of Visual Impairment and Blindness, 97*, 418–428.

Gao, X., & Maurer, D. (2009). Influence of intensity on children's sensitivity to happy, sad, and fearful facial expressions. *Journal of Experimental Child Psychology, 102*, 503–521. https://doi.org/10.1016/j.jecp.2008.11.002

Gao, X., & Maurer, D. (2010). A happy story: Developmental changes in children's sensitivity to facial expressions of varying intensities. *Journal of Experimental Child Psychology, 107*, 67–86. https://doi.org/10.1016/j.jecp.2010.05.003

Gao, X., Maurer, D., & Nishimura, M. (2013). Altered representation of facial expressions after early visual deprivation. *Frontiers in Psychology, 4*, 1–11. https://doi.org/10.3389/fpsyg.2013.00878

Garvert, M. M., Friston, K. J., Dolan, R. J., & Garrido, M. I. (2014). Subcortical amygdala pathways enable rapid face processing. *NeuroImage, 102*, 309–316. https://doi.org/10.1016/j.neuroimage.2014.07.047

Geangu, E., Ichikaw, H., Lao, J., Kanazawa, S., Yamaguchi, M. K., Caldara, R., & Turati, C. (2016). Culture shapes 7-month-olds' perceptual strategies in discriminating facial expressions of emotion. *Current Biology, 26*, R663–R664. https://doi.org/10.1016/j.cub.2016.05.072

Geldart, S., Mondloch, C. J., Maurer, D., de Schonen, S., & Brent, H. P. (2002). The effect of early visual deprivation on the development of face processing. *Developmental Science, 5*, 490–501. https://doi.org/10.1111/desc.12065

Gendron, M. (2017). Revisiting diversity: Cultural variation reveals the constructed nature of emotion perception. *Current Opinion in Psychology, 17*, 145–150. https://doi.org/10.1016/j.copsyc.2017.07.014

Gendron, M., Roberson, D., van der Vyver, J. M., & Barrett, L. F. (2014). Perceptions of emotion from facial expressions are not culturally universal: Evidence from a remote culture. *Emotion, 14*(2), 251–262. https://doi.org/10.1037/a0036052

Georgescu, A. L., Kuzmanovic, B., Roth, D., Bente, G., & Vogeley, K. (2014). The use of virtual characters to assess and train non-verbal communication in high-functioning autism. *Frontiers in Human Neuroscience, 8*, 1–17. https://doi.org/10.3389/fnhum.2014.00807

Georgiou, G. A., Bleakley, C., Hayward, J., Russo, R., Dutton, K., Eltiti, S., & Fox, E. (2005). Focusing on fear: Attentional disengagement from emotional faces. *Visual Cognition, 12*, 145–158. https://doi.org/10.1080/13506280444000076

Gliga, T., & Dehaene-Lambertz, G. (2005). Structural encoding of body and face in human infants and adults. *Journal of Cognitive Neuroscience, 17*, 1328–1340. https://doi.org/10.1162/0898929055002481

Goksan, S., Hartley, C., Emery, F., Cockrill, N., Poorun, R., Moultrie, F., … Slater, R. (2015). fMRI reveals neural activity overlap between adult and infant pain. *eLife, 4*, 1–13. https://doi.org/10.7554/eLife.06356

Gosselin, P., Roberge, P., & Lavallée, M.-F. (1995). Le développement de la reconnaissance des expressions faciales émotionnelles du répertoire humain. *Enfance, 48*, 379–396.

Graham, A. M., Fisher, P. A., & Pfeifer, J. H. (2013). What sleeping babies hear: A functional MRI study of interparental conflict and infants' emotion process-

ing. *Psychological Science, 24*, 782–789. https://doi.org/10.1177/0956797612458803

Graham, A. M., Pfeifer, J. H., Fisher, P. A., Carpenter, S., & Fair, D. A. (2015). Early life stress is associated with default system integrity and emotionality during infancy. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 56*, 1212–1222. https://doi.org/10.1111/jcpp.12409

Greenfield, P. M. (2013). The changing psychology of culture from 1800 through 2000. *Psychological Science, 24*, 1722–1731. https://doi.org/10.1177/0956797613479387

Grelotti, D. J., Gauthier, I., & Schultz, R. T. (2002). Social interest and the development of cortical face specialization: What autism teaches us about face processing. *Developmental Psychobiology, 40*, 213–225. https://doi.org/10.1002/dev.10028

Gross, A. L., & Ballif, B. (1991). Children's understanding of emotion from facial expressions and situations: A review. *Developmental Review, 11*, 368–398. https://doi.org/10.1016/0273-2297(91)90019-K

Grossmann, T., & Jessen, S. (2017). When in infancy does the "fear bias" develop? *Journal of Experimental Child Psychology, 153*, 149–154.

Grossmann, T., Johnson, M. H., Vaish, A., Hughes, D. A., Quinque, D., Stoneking, M., & Friederici, A. D. (2011). Genetic and neural dissociation of individual responses to emotional expressions in human infants. *Developmental Cognitive Neuroscience, 1*, 57–66. https://doi.org/10.1016/j.dcn.2010.07.001

Grossmann, T., Striano, T., & Friederici, A. D. (2006). Crossmodal integration of emotional information from face and voice in the infant brain. *Developmental Science, 9*, 309–315.

Grossmann, T., Striano, T., & Friederici, A. D. (2007). Developmental changes in infants' processing of happy and angry facial expressions: A neurobehavioral study. *Brain and Cognition, 64*, 30–41. https://doi.org/10.1016/j.bandc.2006.10.002

Guy, M. W., Zieber, N., & Richards, J. E. (2016). The cortical development of specialized face processing in infancy. *Child Development, 87*, 1581–1600. https://doi.org/10.1111/cdev.12543

Guyer, A. E., Monk, C. S., McClure-Tone, E. B., Nelson, E. E., Roberson-Nay, R., Adler, A. D., … Ernst, M. (2008). A developmental examination of amygdala response to facial expressions. *Journal of Cognitive Neuroscience, 20*, 1565–1582. https://doi.org/10.1162/jocn.2008.20114

Hagège, C. (2006). Vers une typologie linguistique des affects. *Bulletin de La Société de Linguistique de Paris, 101*, 89–132.

Harms, M. B., Martin, A., & Wallace, G. L. (2010). Facial emotion recognition in autism spectrum disorders: A review of behavioral and neuroimaging studies. *Neuropsychology Review, 20*, 290–322. https://doi.org/10.1007/s11065-010-9138-6

Hassin, R. R., Aviezer, H., & Bentin, S. (2013). Inherently ambiguous: Facial expressions of emotions, in context. *Emotion Review, 5*, 60–65. https://doi.org/10.1177/1754073912451331

Hattingh, C. J., Ipser, J., Tromp, S. A., Syal, S., Lochner, C., Brooks, S. J., & Stein, D. J. (2013). Functional magnetic resonance imaging during emotion recognition in social anxiety disorder: An activation likelihood meta-analysis. *Frontiers in Human Neuroscience, 6*(January), 1–7. https://doi.org/10.3389/fnhum.2012.00347

Haxby, J. V., Hoffman, E. A., & Gobbini, I. M. (2000). The distributed human neural system for face perception. *Trends in Cognitive Sciences, 4*, 223–233. https://doi.org/10.1016/S1364-6613(00)01482-0

Heck, A., Hock, A., White, H., Jubran, R., & Bhatt, R. S. (2016). The development of attention to dynamic facial emotions. *Journal of Experimental Child Psychology, 147*, 100–110.

Hehman, E., Ingbretsen, Z. a., & Freeman, J. B. J. (2014). The neural basis of stereotypic impact on multiple social categorization. *NeuroImage, 101*, 704–711. https://doi.org/10.1016/j.neuroimage.2014.07.056

Helzer, E. G., Connor-Smith, J. K., & Reed, M. A. (2009). Traits, states, and attentional gates: Temperament and threat relevance as predictors of attentional bias to social threat. *Anxiety, Stress and Coping, 22*, 57–76. https://doi.org/10.1080/10615800802272244

Herba, C., & Phillips, M. (2004). Annotation: Development of facial expression recognition from childhood to adolescence: Behavioural and neurological perspectives. *Journal of Child Psychology and Psychiatry, 45*, 1185–1198. https://doi.org/10.1111/j.1469-7610.2004.00316.x

Hill, E., Berthoz, S., & Frith, U. (2004). Brief report: Cognitive processing of own emotions in individuals with autistic spectrum disorder and in their relatives. *Journal of Autism and Developmental Disorders, 34*, 229–235.

Hoehl, S., & Pauen, S. (2011). Do surprised faces affect infants' attention toward novel objects ? *Neuroreport, 22*, 906–910. https://doi.org/10.1097/WNR.0b013e32834cd751

Hoehl, S., & Striano, T. (2008). Neural processing of eye gaze and threat-related emotional facial expressions in infancy. *Child Development, 79*, 1752–1760. https://doi.org/10.1111/j.1467-8624.2008.01223.x

Hoehl, S., & Striano, T. (2010). The development of emotional face and eye gaze processing. *Developmental Science, 13*(6), 813–825. https://doi.org/10.1111/j.1467-7687.2009.00944.x

Hoehl, S., Wiese, L., & Striano, T. (2008). Young infants' neural processing of objects is affected by eye gaze direction and emotional expression. *PLoS One, 3*, e2389. https://doi.org/10.1371/journal.pone.0002389

Hung, Y., Smith, M. L., & Taylor, M. J. (2012). Development of ACC-amygdala activations in processing unattended fear. *NeuroImage, 60*, 545–552. https://doi.org/10.1016/j.neuroimage.2011.12.003

Itier, R. J., & Taylor, M. J. (2004). Source analysis of the N170 to faces and objects. *Neuroreport, 15*, 1261–1265.

Jack, R. E., Blais, C., Scheepers, C., Schyns, P. G., & Caldara, R. (2009). Cultural confusions show that facial expressions are not universal. *Current Biology, 19*, 1543–1548. https://doi.org/10.1016/j.cub.2009.07.051

Jack, R. E., Garrod, O. G. B., & Schyns, P. G. (2014). Dynamic facial expressions of emotion transmit an evolving hierarchy of signals over time. *Current Biology, 24*, 187–192. https://doi.org/10.1016/j.cub.2013.11.064

Jack, R. E., Garrod, O. G. B., Yu, H., Caldara, R., & Schyns, P. G. (2012). Facial expressions of emotion are not culturally universal. *Proceedings of the National Academy of Sciences, 109*, 7241–7244. https://doi.org/10.1073/pnas.1200155109

Jack, R. E., & Schyns, P. G. (2015). The human face as a dynamic tool for social communication. *Current Biology, 25*, R621–R634. https://doi.org/10.1016/j.cub.2015.05.052

Jack, R. E., Sun, W., Delis, I., Garrod, O. G. B., & Schyns, P. G. (2016). Four not six: Revealing culturally common facial expressions of emotion. *Journal of Experimental Psychology: General, 145*, 708–730. https://doi.org/10.1037/xge0000162

Jessen, S., Altvater-Mackensen, N., & Grossmann, T. (2016). Pupillary responses reveal infants' discrimination of facial emotions independent of conscious perception. *Cognition, 150*, 163–169. https://doi.org/10.1016/j.cognition.2016.02.010

Jessen, S., & Grossmann, T. (2014). Unconscious discrimination of social cues from eye whites in infants. *Proceedings of the National Academy of Sciences, 111*, 16208–16213. https://doi.org/10.1073/pnas.1411333111

Jessen, S., & Grossmann, T. (2015). Neural signatures of conscious and unconscious emotional face processing in human infants. *Cortex, 64*, 260–270. https://doi.org/10.1016/j.cortex.2014.11.007

Jessen, S., & Grossmann, T. (2016). The developmental emergence of unconscious fear processing from eyes during infancy. *Journal of Experimental Child Psychology, 142*, 334–343. https://doi.org/10.1016/j.jecp.2015.09.009

Johnson, M. H., Griffin, R., Csibra, G., Halit, H., Farroni, T., De Haan, M., … Richards, J. (2005). The emergence of the social brain network: Evidence from typical and atypical development. *Development and Psychopathology, 17*, 599–619.

Kagan, J., Reznick, J., & Snidman, N. (1988). Biological bases of childhood shyness. *Science, 240*, 167–171. https://doi.org/10.1126/science.3353713

Kahana-Kalman, R., & Walker-Andrews, A. S. (2001). The role of person familiarity in young infants' perception of emotional expressions. *Child Development, 72*, 352. https://doi.org/10.1111/1467-8624.00283

Kaitz, M., Meschulach-Sarfaty, O., Auerbach, J., & Eidelman, A. (1988). A reexamination of newborns' ability to imitate facial expressions. *Developmental Psychology, 24*, 3.

Kandalaft, M. R., Didehbani, N., Krawczyk, D. C., Allen, T. T., & Chapman, S. B. (2013). Virtual reality social cognition training for young adults with high-functioning autism. *Journal of Autism and Developmental Disorders, 43*, 34–44. https://doi.org/10.1007/s10803-012-1544-6

Kellman, P. J., & Spelke, E. S. (1983). Perception of partly occluded objects in infancy. *Cognitive Psychology, 15*, 483–524. https://doi.org/10.1016/0010-0285(83)90017-8

Kesler-West, M. L., Andersen, A. H., Smith, C. D., Avison, M. J., Davis, C. E., Kryscio, R. J., & Blonder, L. X. (2001). Neural substrates of facial emotion processing using fMRI. *Cognitive Brain Research, 11*, 213–226. https://doi.org/10.1016/S0926-6410(00)00073-2

Killgore, W. D. S., & Yurgelun-Todd, D. A. (2005). Social anxiety predicts amygdala activation in adolescents viewing fearful faces. *Neuroreport, 16*, 1671–1675. https://doi.org/10.1097/01.wnr.0000180143.99267.bd

Killgore, W. D. S., & Yurgelun-Todd, D. A. (2007). Unconscious processing of facial affect in children and adolescents. *Social Neuroscience, 2*, 28–47. https://doi.org/10.1080/17470910701214186

Kobayashi, M., Otsuka, Y., Kanazawa, S., Yamaguchi, M. K., & Kakigi, R. (2012). Size-invariant representation of face in infant brain. *Neuroreport, 23*, 984–988. https://doi.org/10.1097/WNR.0b013e32835a4b86

Kobayashi, M., Otsuka, Y., Nakato, E., Kanazawa, S., Yamaguchi, M. K., & Kakigi, R. (2011). Do infants represent the face in a viewpoint-invariant manner? Neural adaptation study as measured by near-infrared spectroscopy. *Frontiers in Human Neuroscience, 5*, 153. https://doi.org/10.3389/fnhum.2011.00153

Kobiella, A., Grossmann, T., Reid, V. M., & Striano, T. (2008). The discrimination of angry and fearful facial expressions in 7-month-old infants: An event-related potential study. *Cognition and Emotion, 22*, 134–146.

Kotsoni, E., de Haan, M., & Johnson, M. H. (2001). Categorical perception of facial expressions by 7-month-old infants. *Perception, 30*, 1115–1125.

Krebs, J. F., Biswas, A., Pascalis, O., Kamp-Becker, I., Remschmidt, H., & Schwarzer, G. (2011). Face processing in children with autism spectrum disorder: Independent or interactive processing of facial identity and facial expression? *Journal of Autism and Developmental Disorders, 41*, 796–804. https://doi.org/10.1007/s10803-010-1098-4

Krolak-Salmon, P., Hénaff, M.-A., Vighetto, A., Bertrand, O., & Mauguière, F. (2004). Early amygdala reaction to fear spreading in occipital, temporal, and frontal cortex: A depth electrode ERP study in human. *Neuron, 42*, 665–676. https://doi.org/10.1016/S0896-6273(04)00264-8

Kuchuk, A., Vibbert, M., & Bornstein, M. (1986). The perception of smiling and its experiential correlates in three-month-old infants. *Child Development, 57*, 1054–1061. https://doi.org/10.2307/1130379

Kuhl, P. K., Ramirez, R. R., Bosseler, A., Lin, J.-F. L., & Imada, T. (2014). Infants' brain responses to speech suggest analysis by synthesis. *Proceedings of the*

National Academy of Sciences, 111, 1410963111. https://doi.org/10.1073/pnas.1410963111

Kujawa, A., MacNamara, A., Fitzgerald, K. D., Monk, C. S., & Phan, K. L. (2015). Enhanced neural reactivity to threatening faces in anxious youth: Evidence from event-related potentials. *Journal of Abnormal Child Psychology, 43*, 1493–1501. https://doi.org/10.1007/s10802-015-0029-4

La Barbera, J. D., Izard, C. E., Vietze, P., & Parisi, S. A. (1976). Four- and six-month-old infants' visual responses to joy, anger, and neutral expressions. *Child Development, 47*, 535–538.

Le Grand, R., & Mondloch, C. J. (2004). Impairment in holistic face processing following early visual deprivation. *Psychological Science, 15*, 762–768.

Le Grand, R., Mondloch, C. J., Maurer, D., & Brent, H. P. (2003). Expert face processing requires visual input to the right hemisphere during infancy. *Nature Neuroscience, 6*, 1108–1112. https://doi.org/10.1038/nn1121

Lee, D. H., & Anderson, A. K. (2017). Reading what the mind thinks from how the eye sees. *Psychological Science, 28*, 494–503. https://doi.org/10.1177/0956797616687364

Leonardo, E. D., & Hen, R. (2008). Anxiety as a developmental disorder. *Neuropsychopharmacology Reviews, 33*, 134–140. https://doi.org/10.1038/sj.npp.1301569

Leppänen, J. M., Milders, M., Bell, J. S., Terriere, E., & Hietanen, J. K. (2004). Depression biases the recognition of emotionally neutral faces. *Psychiatry Research, 128*, 123–133. https://doi.org/10.1016/j.psychres.2004.05.020

Leppänen, J. M., Moulson, M. C., Vogel-Farley, V. K., & Nelson, C. A. (2007). An ERP study of emotional face processing in the adult and infant brain. *Child Development, 78*, 232–245.

Leppänen, J. M., & Nelson, C. A. (2009). Tuning the developing brain to social signals of emotions. *Nature Review Neuroscience, 10*, 37–47. https://doi.org/10.1038/nrn2554

Leppänen, J. M., & Nelson, C. A. (2012). Early development of fear processing. *Current Directions in Psychological Science, 21*, 200–204. https://doi.org/10.1177/0963721411435841

Leppänen, J. M., Peltola, M. J., Mantymaa, M., Koivuluoma, M., Salminen, A., & Puura, K. (2010). Cardiac and behavioral evidence for emotional influences on attention in 7-month-old infants. *International Journal of Behavioral Development, 34*, 547–553. https://doi.org/10.1177/0165025410365804

Lew, S., Sliva, D. D., Choe, M. S., Grant, P. E., Okada, Y., Wolters, C. H., & Hämäläinen, M. S. (2013). Effects of sutures and fontanels on MEG and EEG source analysis in a realistic infant head model. *NeuroImage, 76*, 282–293. https://doi.org/10.1016/j.neuroimage.2013.03.017.Effects

Lindquist, K. A., Satpute, A. B., Wager, T. D., Weber, J., & Barrett, L. F. (2016). The brain basis of positive and negative affect: Evidence from a meta-analysis of the human neuroimaging literature. *Cerebral Cortex, 26*, 1910–1922. https://doi.org/10.1093/cercor/bhv001

Lindquist, K. A., Wager, T. D., Kober, H., Bliss-Moreau, E., & Barrett, L. F. (2012). The brain basis of emotion: A meta-analytic review. *Behavioral and Brain Sciences, 35*, 121–143. https://doi.org/10.1017/S0140525X11000446

Lobaugh, N. J., Gibson, E., & Taylor, M. J. (2006). Children recruit distinct neural systems for implicit emotional face processing. *Neuroreport, 17*, 215–219. https://doi.org/10.1097/01.wnr.0000198946.00445.2f

LoBue, V. (2012). Perceptual biases for threat. In *Psychology of bias* (pp. 37–52). Hauppauge, NY: Nova Science Publishers.

LoBue, V., & Deloache, J. S. (2010). Superior detection of threat-relevant stimuli in infancy. *Developmental Science, 13*, 221–228. https://doi.org/10.1111/j.1467-7687.2009.00872.x

LoBue, V., & Rakison, D. H. (2013). What we fear most: A developmental advantage for threat-relevant stimuli. *Developmental Review, 33*, 285–303. https://doi.org/10.1016/j.dr.2013.07.005

LoBue, V., Rakison, D. H., & DeLoache, J. S. (2010). Threat perception across the life span: Evidence for multiple converging pathways. *Current Directions in Psychological Science, 19*, 375–379. https://doi.org/10.1177/0963721410388801

Lonigan, C. J., Vasey, M. W., Phillips, B. M., & Hazen, R. A. (2004). Temperament, anxiety, and the processing of threat-relevant stimuli. *Journal of Clinical Child & Adolescent Psychology, 33*, 8–20. https://doi.org/10.1207/S15374424JCCP3301_2

Lozier, L. M., Vanmeter, J. W., & Marsh, A. A. (2014). Impairments in facial affect recognition associated with autism spectrum disorders: A meta-analysis. *Development and Psychopathology, 26*, 933–945. https://doi.org/10.1017/S0954579414000479

Ludemann, P. M. (1991). Generalized discrimination of positive facial expressions by seven- and ten-month-old infants. *Child Development, 62*, 55.

Ludemann, P. M., & Nelson, C. A. (1988). Categorical representation of facial expressions by 7-month-old infants. *Developmental Psychology, 24*, 492–501. https://doi.org/10.1037//0012-1649.24.4.492

Lueken, U., Zierhut, K. C., Hahn, T., Straube, B., Kircher, T., Reif, A., … Domschke, K. (2016). Neurobiological markers predicting treatment response in anxiety disorders: A systematic review and implications for clinical application. *Neuroscience and Biobehavioral Reviews, 66*, 143–162. https://doi.org/10.1016/j.neubiorev.2016.04.005

Luo, W., Feng, W., He, W., Wang, N.-Y., & Luo, Y.-J. (2010). Three stages of facial expression processing: ERP study with rapid serial visual presentation. *NeuroImage, 49*, 1857–1867. https://doi.org/10.1016/j.neuroimage.2009.09.018

Luyster, R. J., Bick, J., Westerlund, A., & Nelson, C. A. (2019). Testing the effects of expression, intensity and age on emotional face processing in

ASD. *Neuropsychologia, 126*, 128–137. https://doi.org/10.1016/j.neuropsychologia.2017.06.023

Machado-de-Sousa, J. P., Arrais, K. C., Alves, N. T., Chagas, M. H. N., de Meneses-Gaya, C., Crippa, J. A. d. S., & Hallak, J. E. C. (2010). Facial affect processing in social anxiety: Tasks and stimuli. *Journal of Neuroscience Methods, 193*, 1–6. https://doi.org/10.1016/j.jneumeth.2010.08.013

Malatesta, C. Z., Grigoryev, P., Lamb, C., Albin, M., & Culver, C. (1986). Emotion socialization and expressive development in preterm and full-term infants. *Child Development, 57*, 316–330. https://doi.org/10.2307/1130587

Mancini, G., Agnoli, S., Baldaro, B., Ricci Bitti, P. E., & Surcinelli, P. (2013). Facial expressions of emotions: Recognition accuracy and affective reactions during late childhood. *Journal of Psychology, 147*, 599–617.

Marr, D. (1982). Vision: A computational investigation into the human representation and processing of visual information. *Phenomenology and the Cognitive Sciences, 8*, 397. https://doi.org/10.1007/s11097-009-9141-7

Mathews, A., & MacLeod, C. (2005). Cognitive vulnerability to emotional disorders. *Annual Review of Clinical Psychology, 1*, 167–195. https://doi.org/10.1146/annurev.clinpsy.1.102803.143916

Maurer, D., Le Grand, R., & Mondloch, C. J. (2002). The many faces of configural processing. *Trends in Cognitive Sciences, 6*, 255–260. https://doi.org/10.1016/S1364-6613(02)01903-4

Maurer, D., Lewis, T. L., & Mondloch, C. J. (2005). Missing sights: Consequences for visual cognitive development. *Trends in Cognitive Sciences, 9*, 144–151. https://doi.org/10.1016/j.tics.2005.01.006

McClure, E. B., Adler, A., Monk, C. S., Cameron, J., Smith, S., Nelson, E. E., … Pine, D. S. (2007). fMRI predictors of treatment outcome in pediatric anxiety disorders. *Psychopharmacology, 191*, 97–105. https://doi.org/10.1007/s00213-006-0542-9

McClure, E. B., Pope, K., Hoberman, A. J., Pine, D. S., & Leibenluft, E. (2003). Facial expression recognition in adolescents with mood and anxiety disorders. *The American Journal of Psychiatry, 160*, 1172–1174. https://doi.org/10.1176/appi.ajp.160.6.1172

McKay, D., & Tolin, D. F. (2017). Empirically supported psychological treatments and the Research Domain Criteria (RDoC). *Journal of Affective Disorders, 216*, 78–88. https://doi.org/10.1016/j.jad.2016.10.018

McTeague, L. M., Laplante, M.-C., Bulls, H. W., Shumen, J. R., Lang, P. J., & Keil, A. (2018). Face perception in social anxiety: Visuocortical dynamics reveal propensities for hypervigilance or avoidance. *Biological Psychiatry, 83*, 618–628. https://doi.org/10.1016/j.biopsych.2017.10.004

Meltzoff, A. N., & Moore, M. K. (1977). Imitation of facial and manual gestures by human neonates. *Science, 198*, 75–78.

Meltzoff, A. N., & Moore, M. K. (1983). Newborn infants imitate adult facial gestures. *Child Development, 54*, 702–709.

Meltzoff, A. N., Murray, L., Simpson, E., Heimann, M., Nagy, E., Nadel, J., … Ferrari, P. F. (2018). Re-examination of Oostenbroek et al. (2016): Evidence for neonatal imitation of tongue protrusion. *Developmental Science, 21*(4), e12609. https://doi.org/10.1111/desc.12609

Michel, J.-B., Shen, Y. K., Aiden, A. P., Veres, A., Gray, M. K., Pickett, J. P., … Aiden, E. L. (2011). Quantitative analysis of culture using millions of digitized books. *Science, 331*, 176–182. https://doi.org/10.1126/science.1199644

Minagawa-Kawai, Y., Matsuoka, S., Dan, I., Naoi, N., Nakamura, K., & Kojima, S. (2009). Prefrontal activation associated with social attachment: Facial-emotion recognition in mothers and infants. *Cerebral Cortex, 19*, 284–292. https://doi.org/10.1093/cercor/bhn081

Minagawa-Kawai, Y., Mori, K., Hebden, J. C., & Dupoux, E. (2008). Optical imaging of infants' neurocognitive development: Recent advances and perspectives. *Developmental Neurobiology, 68*, 712–728. https://doi.org/10.1002/dneu.20618

Mogg, K., Garner, M., & Bradley, B. P. (2007). Anxiety and orienting of gaze to angry and fearful faces. *Biological Psychology, 76*, 163–169. https://doi.org/10.1016/j.biopsycho.2007.07.005

Monk, C. S., McClure, E. B., Nelson, E. E., Zarahn, E., Bilder, R. M., Leibenluft, E., … Pine, D. S. (2003). Adolescent immaturity in attention-related brain engagement to emotional facial expressions. *NeuroImage, 20*, 420–428. https://doi.org/10.1016/S1053-8119(03)00355-0

Montague, D. P. F., & Walker-Andrews, A. S. (2002). Mothers, fathers, and infants: The role of person familiarity and parental involvement in infants' perception of emotion expressions. *Child Development, 73*, 1339–1352.

Monteiro, R., Simões, M., Andrade, J., & Castelo Branco, M. (2017). Processing of facial expressions in autism: A systematic review of EEG/ERP evidence. *Review Journal of Autism and Developmental Disorders, 4*(4), 255–276. https://doi.org/10.1007/s40489-017-0112-6

Montgomery, K. J., & Haxby, J. V. (2008). Mirror neuron system differentially activated by facial expressions and social hand gestures: A functional magnetic resonance imaging study. *Journal of Cognitive Neuroscience, 20*, 1866–1877. https://doi.org/10.1162/jocn.2008.20127

Montirosso, R., Peverelli, M., Frigerio, E., Crespi, M., & Borgatti, R. (2010). The development of dynamic facial expression recognition at different intensities in 4- to 18-year-olds. *Social Development, 19*, 71–92. https://doi.org/10.1111/j.1467-9507.2008.00527.x

Moore, W. E., Pfeifer, J. H., Masten, C. L., Mazziotta, J. C., Iacoboni, M., & Dapretto, M. (2012). Facing puberty: Associations between pubertal development and neural responses to affective facial displays. *Social Cognitive and Affective Neuroscience, 7*(1), 35–43. https://doi.org/10.1093/scan/nsr066

Morales, S., Fu, X., & Pérez-Edgar, K. E. (2016). A developmental neuroscience perspective on affect-biased

attention. *Developmental Cognitive Neuroscience, 21*, 26–41. https://doi.org/10.1016/j.dcn.2016.08.001

Morgan, B. E. (2006). Behavioral inhibition: A neurobiological perspective. *Current Psychiatry Reports, 8*, 270–278. https://doi.org/10.1007/s11920-006-0062-7

Motta-Mena, N. V., & Scherf, K. S. (2017). Pubertal development shapes perception of complex facial expressions. *Developmental Science, 20*(4), 1–10. https://doi.org/10.1111/desc.12451

Moulson, M. C., Shutts, K., Fox, N. A., Zeanah, C. H., Spelke, E. S., & Nelson, C. A. (2015). Effects of early institutionalization on the development of emotion processing: A case for relative sparing? *Developmental Science, 18*, 298–313. https://doi.org/10.1111/desc.12217

Nakagawa, A., & Sukigara, M. (2012). Difficulty in disengaging from threat and temperamental negative affectivity in early life: A longitudinal study of infants aged 12–36 months. *Behavioral and Brain Functions, 8*, 1–8.

Nakato, E., Otsuka, Y., Kanazawa, S., Yamaguchi, M. K., & Kakigi, R. (2011). Distinct differences in the pattern of hemodynamic response to happy and angry facial expressions in infants—a near-infrared spectroscopic study. *NeuroImage, 54*, 1600–1606.

Nakato, E., Otsuka, Y., Kanazawa, S., Yamaguchi, M. K., Watanabe, S., & Kakigi, R. (2009). When do infants differentiate profile face from frontal face? A near-infrared spectroscopic study. *Human Brain Mapping, 30*, 462–472. https://doi.org/10.1002/hbm.20516

Namburi, P., Beyeler, A., Yorozu, S., Calhoon, G. G., Halbert, S. a., Wichmann, R., … Tye, K. M. (2015). A circuit mechanism for differentiating positive and negative associations. *Nature, 520*, 675–678. https://doi.org/10.1038/nature14366

Nelson, C. A. (1987). The recognition of facial expressions in the first two years of life: Mechanisms of development. *Child Development, 58*, 889–909.

Nelson, C. A. (2003). The development of face recognition reflects an experience-expectant and activity-dependent process. In *The development of face processing in infancy and early childhood: Current perspectives* (pp. 79–97). New York, NY: Nova Science Publishers.

Nelson, C. A., & De Haan, M. (1996). Neural correlates of infants' visual responsiveness to facial expressions of emotion. *Developmental Psychobiology, 29*, 577–595.

Nelson, C. A., & Dolgin, K. G. (1985). The generalized discrimination of facial expressions by seven-month-old infants. *Child Development, 56*, 58–61.

Nelson, C. A., Morse, P. A., & Leavitt, L. A. (1979). Recognition of facial expressions by seven-month-old infants. *Child Development, 50*, 1239.

Nelson, E. E., Leibenluft, E., McClure, E. B., & Pine, D. S. (2005). The social re-orientation of adolescence: A neuroscience perspective on the process and its relation to psychopathology. *Psychological Medicine, 35*, 163–174. https://doi.org/10.1017/S0033291704003915

Nelson, E. E., McClure, E. B., Monk, C. S., Zarahn, E., Leibenluft, E., Pine, D. S., & Ernst, M. (2003). Developmental differences in neuronal engagement during implicit encoding of emotional faces: An event-related fMRI study. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 44*, 1015–1024. https://doi.org/10.1111/1469-7610.00186

Nelson, N. L., & Russell, J. A. (2013). Universality revisited. *Emotion Review, 5*, 8–15. https://doi.org/10.1103/PhysRevD.5.776

Neuhaus, E., Jones, E. J. H., Barnes, K., Sterling, L., Estes, A., Munson, J., … Webb, S. J. (2016). The relationship between early neural responses to emotional faces at age 3 and later autism and anxiety symptoms in adolescents with autism. *Journal of Autism and Developmental Disorders, 46*, 2450–2463. https://doi.org/10.1007/s10803-016-2780-y

Nuske, H. J., Vivanti, G., & Dissanayake, C. (2013). Are emotion impairments unique to, universal, or specific in autism spectrum disorder? A comprehensive review. *Cognition & Emotion, 27*, 1042–1061. https://doi.org/10.1080/02699931.2012.762900

Oakes, L. M. (2017). Sample size, statistical power, and false conclusions in infant looking-time research. *Infancy, 22*, 436–469. https://doi.org/10.1111/infa.12186

Oerlemans, A. M., Van Der Meer, J. M. J., Van Steijn, D. J., De Ruiter, S. W., De Bruijn, Y. G. E., De Sonneville, L. M. J., … Rommelse, N. N. J. (2014). Recognition of facial emotion and affective prosody in children with ASD (+ADHD) and their unaffected siblings. *European Child and Adolescent Psychiatry, 23*, 257–271. https://doi.org/10.1007/s00787-013-0446-2

ojalehto, b. l., & Medin, D. L. (2015). Perspectives on culture and concepts. *Annual Review of Psychology, 66*, 249–275. https://doi.org/10.1146/annurev-psych-010814-015120

Ong, D. C., Asaba, M., & Gweon, H. (2016). Young children and adults integrate past expectations and current outcomes to reason about others' emotions. In *Proceedings of the 38th Annual Meeting of the Cognitive Science Society* (pp. 135–140).

Oostenbroek, J., Slaughter, V., Nielsen, M., & Suddendorf, T. (2013). Why the confusion around neonatal imitation? A review. *Journal of Reproductive and Infant Psychology, 31*, 328–341. https://doi.org/10.1080/02646838.2013.832180

Oostenbroek, J., Suddendorf, T., Nielsen, M., Redshaw, J., Kennedy-Costantini, S., Davis, J., … Slaughter, V. (2016). Comprehensive longitudinal study challenges the existence of neonatal imitation in humans. *Current Biology, 26*, 1334–1338. https://doi.org/10.1016/j.cub.2016.03.047

Oster, H. (1981). "Recognition" of emotional expression in infancy. In M. E. Lamb & L. R. Sherrod (Eds.), *Infant social cognition: Empirical and theoretical considerations* (pp. 85–125). Hillsdale, NJ: Erlbaum.

Osterling, J., & Dawson, G. (1994). Early recognition of children with autism: A study of first birthday home videotapes. *Journal of Autism and Developmental Disorders, 24*, 247–257. https://doi.org/10.1007/BF02172225

Otte, R. A., Donkers, F. C. L., Braeken, M. A. K. A., & Van den Bergh, B. R. H. (2015). Multimodal processing of emotional information in 9-month-old infants II: Prenatal exposure to maternal anxiety. *Brain and Cognition, 95*, 107–117. https://doi.org/10.1016/j.bandc.2014.12.001

Parker, S. W., Nelson, C. A., & The Bucarest Early Intervention Project Core Group. (2005). The impact of early institutional rearing on the ability to discriminate facial expressions of emotion: An event-related potential study. *Child Development, 76*, 54–72.

Passarotti, A. M., Sweeney, J. A., & Pavuluri, M. N. (2009). Neural correlates of incidental and directed facial emotion processing in adolescents and adults. *Social Cognitive and Affective Neuroscience, 4*, 387–398. https://doi.org/10.1093/scan/nsp029

Pauen, S., Birgit, T., Hoehl, S., & Bechtel, S. (2015). Show me the world: Object categorization and socially guided object learning in infancy. *Child Development Perspectives, 9*, 111–116. https://doi.org/10.1111/cdep.12119

Peelen, M. V., Atkinson, A. P., & Vuilleumier, P. (2010). Supramodal representations of perceived emotions in the human brain. *Journal of Neuroscience, 30*, 10127–10134. https://doi.org/10.1523/jneurosci.2161-10.2010

Peltola, M. J., Forssman, L., Puura, K., Van Ijzendoorn, M. H., & Leppänen, J. M. (2015). Attention to faces expressing negative emotion at 7 months predicts attachment security at 14 months. *Child Development, 86*, 1321–1332. https://doi.org/10.1111/cdev.12380

Peltola, M. J., Hietanen, J. K., Forssman, L., & Leppänen, J. M. (2013). The emergence and stability of the attentional bias to fearful faces in infancy. *Infancy, 18*, 905–926. https://doi.org/10.1111/infa.12013

Peltola, M. J., Leppänen, J. M., & Hietanen, J. K. (2011). Enhanced cardiac and attentional responding to fearful faces in 7-month-old infants. *Psychophysiology, 48*, 1291–1298. https://doi.org/10.1111/j.1469-8986.2011.01188.x

Peltola, M. J., Leppänen, J. M., Mäki, S., & Hietanen, J. K. (2009). Emergence of enhanced attention to fearful faces between 5 and 7 months of age. *Social Cognitive and Affective Neuroscience, 4*, 134–142. https://doi.org/10.1093/scan/nsn046

Peltola, M. J., Leppänen, J. M., Palokangas, T., & Hietanen, J. K. (2008). Fearful faces modulate looking duration and attention disengagement in 7-month-old infants. *Developmental Science, 11*, 60–68.

Peltola, M. J., Leppänen, J. M., Vogel-Farley, V. K., Hietanen, J. K., & Nelson, C. A. (2009). Fearful faces but not fearful eyes alone delay attention disengagement in 7-month-old infants. *Emotion, 9*, 560–565. https://doi.org/10.1037/a0015806

Pessoa, L., & Adolphs, R. (2010). Emotion processing and the amygdala: From a "low road" to "many roads" of evaluating biological significance. *Nature Reviews Neuroscience, 11*, 773–783. https://doi.org/10.1038/nrn2920

Pessoa, L., & Adolphs, R. (2011). Emotion and the brain: Multiple roads are better than one. *Nature Reviews Neuroscience, 12*, 425–425. https://doi.org/10.1038/nrn2920-c2

Peterson, M. F., & Eckstein, M. P. (2012). Looking just below the eyes is optimal across face recognition tasks. *Proceedings of the National Academy of Sciences, 109*, E3314–E3323. https://doi.org/10.1073/pnas.1214269109

Phan, K. L., Fitzgerald, D. A., Nathan, P. J., & Tancer, M. E. (2006). Association between amygdala hyperactivity to harsh faces and severity of social anxiety in generalized social phobia. *Biological Psychiatry, 59*, 424–429. https://doi.org/10.1016/j.biopsych.2005.08.012

Phillips, A. T., Wellman, H. M., & Spelke, E. S. (2002). Infants' ability to connect gaze and emotional expression to intentional action. *Cognition, 85*, 53–78. https://doi.org/10.1016/S0010-0277(02)00073-2

Phillips, M. L., Drevets, W. C., Rauch, S. L., & Lane, R. (2003). Neurobiology of emotion perception I: The neural basis of normal emotion perception. *Biological Psychiatry, 54*, 504–514. https://doi.org/10.1016/S0006-3223(03)00168-9

Picci, G., & Scherf, K. S. (2016). From caregivers to peers: Puberty shapes human face perception. *Psychological Science, 27*, 1461–1473. https://doi.org/10.1177/0956797616663142

Pine, D. S., Mogg, K., Bradley, B. P., Montgomery, L. A., Monk, C. S., McClure, E., … Kaufman, J. (2005). Attention bias to threat in maltreated children: Implications for vulnerability to stress-related psychopathology. *American Journal of Psychiatry, 162*, 291–296. https://doi.org/10.1176/appi.ajp.162.2.291

Pinel, P., Lalanne, C., Bourgeron, T., Fauchereau, F., Poupon, C., Artiges, E., … Dehaene, S. (2015). Genetic and environmental influences on the visual word form and fusiform face areas. *Cerebral Cortex, 25*, 2478–2493. https://doi.org/10.1093/cercor/bhu048

Pollak, S. D., Cicchetti, D., Hornung, K., & Reed, A. (2000). Recognizing emotion in faces: Developmental effects of child abuse and neglect. *Developmental Psychology, 36*, 679–688. https://doi.org/10.1037//0012-1649.36.5.679

Pollak, S. D., & Kistler, D. J. (2002). Early experience is associated with the development of categorical representations for facial expressions of emotion. *Proceedings of the National Academy of Sciences, 99*, 9072–9076. https://doi.org/10.1073/pnas.142165999

Pollak, S. D., Messner, M., Kistler, D. J., & Cohn, J. F. (2009). Development of perceptual expertise in emotion recognition. *Cognition, 110*, 242–247. https://doi.org/10.1016/j.cognition.2008.10.010

Pollak, S. D., & Sinha, P. (2002). Effects of early experience on children's recognition of facial displays of emotion. *Developmental Psychology, 38*, 784–791. https://doi.org/10.1037/0012-1649.38.5.784

Puliafico, A. C., & Kendall, P. C. (2006). Threat-related attentional bias in anxious youth: A review. *Clinical*

Child and Family Psychology Review, 9, 162–180. https://doi.org/10.1007/s10567-006-0009-x

Ramsey-Rennels, J. L., & Langlois, J. H. (2006). Infants' differential processing of female and male faces. *Current Directions in Psychological Science, 15*, 59–62. https://doi.org/10.1111/j.0963-7214.2006.00407.x

Reeb-Sutherland, B. C., Rankin Williams, L., Degnan, K. A., Pérez-Edgar, K., Chronis-Tuscano, A., Leibenluft, E., … Fox, N. A. (2015). Identification of emotional facial expressions among behaviorally inhibited adolescents with lifetime anxiety disorders. *Cognition and Emotion, 29*, 372–382. https://doi.org/10.1080/02699931.2014.913552

Reissland, N., Francis, B., Mason, J., & Lincoln, K. (2011). Do facial expressions develop before birth? *PLoS One, 6*, e24081. https://doi.org/10.1371/journal.pone.0024081

Rennels, J. L., & Davis, R. E. (2008). Facial experience during the first year. *Infant Behavior and Development, 31*, 665–678. https://doi.org/10.1016/j.infbeh.2008.04.009

Reynolds, G. D., & Richards, J. E. (2005). Familiarization, attention, and recognition memory in infancy: An event-related potential and cortical source localization study. *Developmental Psychology, 41*, 598–615. https://doi.org/10.1037/0012-1649.41.4.598

Richoz, A.-R., Jack, R. E., Garrod, O. G. B., Schyns, P. G., & Caldara, R. (2015). Reconstructing dynamic mental models of facial expressions in prosopagnosia reveals distinct representations for identity and expression. *Cortex, 65*, 50–64. https://doi.org/10.1016/j.cortex.2014.11.015

Rigato, S., Menon, E., Johnson, M. H., & Farroni, T. (2011). The interaction between gaze direction and facial expressions in newborns. *European Journal of Developmental Psychology, 8*, 624–636.

Rochat, P., Striano, T., & Blatt, L. (2002). Differential effects of happy, neutral, and sad still-faces on 2-, 4- and 6-month-old infants. *Infant and Child Development, 11*, 289–303.

Rodger, H., Vizioli, L., Ouyang, X., & Caldara, R. (2015). Mapping the development of facial expression recognition. *Developmental Science, 18*, 926–939. https://doi.org/10.1111/desc.12281

Rogers, C. E., Sylvester, C. M., Mintz, C., Kenley, J. K., Shimony, J. S., Barch, D. M., & Smyser, C. D. (2017). Neonatal amygdala functional connectivity at rest in healthy and preterm infants and early internalizing symptoms. *Journal of the American Academy of Child & Adolescent Psychiatry, 56*, 157–166. https://doi.org/10.1016/j.jaac.2016.11.005

Rottman, J. (2014). Evolution, development, and the emergence of disgust. *Evolutionary Psychology, 12*, 417–433.

Roy, A. K., Vasa, R. A., Bruck, M., Mogg, K., Bradley, B. P., Sweeney, M., … CAMS Team. (2008). Attention bias toward threat in pediatric anxiety disorders. *Journal of the American Academy of Child and Adolescent Psychiatry, 47*, 1189–1196. https://doi.org/10.1097/CHI.0b013e3181825ace.Attention

Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology, 39*, 1161–1178.

Russell, J. A., & Bullock, M. (1985). Multidimensional scaling of emotional facial expressions: Similarity from preschoolers to adults. *Journal of Personality and Social Psychology, 48*, 1290–1298. https://doi.org/10.1037/0022-3514.48.5.1290

Russell, J. A., & Bullock, M. (1986). On the dimensions preschoolers use to interpret facial expressions of emotion. *Developmental Psychology, 22*, 97–102. https://doi.org/10.1037/0012-1649.22.1.97

Russell, J. A., & Widen, S. C. (2002). A label superiority effect in children's categorization of facial expressions. *Social Development, 11*, 30–52. https://doi.org/10.1111/1467-9507.00185

Safar, K., & Moulson, M. C. (2017). Recognizing facial expressions of emotion in infancy: A replication and extension. *Developmental Psychobiology, 59*, 507–514. https://doi.org/10.1002/dev.21515

Said, C. P., Haxby, J. V., & Todorov, A. (2011). Brain systems for assessing the affective value of faces. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences, 366*, 1660–1670. https://doi.org/10.1098/rstb.2010.0351

Said, C. P., Moore, C. D., Engell, A. D., & Haxby, J. V. (2010). Distributed representations of dynamic facial expressions in the superior temporal sulcus. *Journal of Vision, 10*, 1–12. https://doi.org/10.1167/10.5.11.Introduction

Salum, G. A., Mogg, K., Bradley, B. P., Gadelha, A., Pan, P., Tamanaha, A. C., … Pine, D. S. (2013). Threat bias in attention orienting: Evidence of specificity in a large community-based study. *Psychological Medicine, 43*, 733–745. https://doi.org/10.1017/S0033291712001651

Sauter, D. A., & Eisner, F. (2013). Commonalities outweigh differences in the communication of emotions across human cultures. *Proceedings of the National Academy of Sciences, 110*, E180. https://doi.org/10.1073/pnas.1209522110

Saxe, R., & Houlihan, S. D. (2017). Formalizing emotion concepts within a Bayesian model of theory of mind. *Current Opinion in Psychology, 17*, 15–21. https://doi.org/10.1016/j.copsyc.2017.04.019

Schweinberger, S. R., Pickering, E. C., Jentzsch, I., Burton, M. A., & Kaufmann, J. M. (2002). Event-related brain potential evidence for a response of inferior temporal cortex to familiar face repetitions. *Cognitive Brain Research, 14*, 398–409.

Schyns, P. G., Petro, L. S., & Smith, M. L. (2007). Dynamics of visual information integration in the brain for categorizing facial expressions. *Current Biology, 17*, 1580–1585. https://doi.org/10.1016/j.cub.2007.08.048

Scott-Phillips, T. C. (2008). Defining biological communication. *Journal of Evolutionary Biology, 21*, 387–395. https://doi.org/10.1111/j.1420-9101.2007.01497.x

Scott-Phillips, T. C., & Kirby, S. (2013). Information, influence and inference in language evolution. In U. E. Stegmann (Ed.), *Animal communication theory: Information and influence* (pp. 421–442). Cambridge, UK: Cambridge University Press.

Serrano, J. J. M., Iglesias, J., & Loeches, A. (1992). Visual discrimination and recognition of facial expressions of anger, fear, and surprise in 4- to 6-month-old infants. *Developmental Psychobiology, 25*, 411–425.

Shah, S. G., Klumpp, H., Angstadt, M., Nathan, P. J., & Phan, K. L. (2009). Amygdala and insula response to emotional images in patients with generalized social anxiety disorder. *Journal of Psychiatry and Neuroscience, 34*, 296–302.

Shin, L. M., & Liberzon, I. (2010). The neurocircuitry of fear, stress, and anxiety disorders. *Neuropsychopharmacology, 35*, 169–191. https://doi.org/10.1038/npp.2009.83

Silver, M., & Oakes, P. (2001). Evaluation of a new computer intervention to teach people with autism or Asperger syndrome to recognize and predict emotions in others. *Autism, 5*, 299–316. https://doi.org/10.1177/1362361301005003007

Skerry, A. E., & Saxe, R. (2014). A common neural code for perceived and inferred emotion. *Journal of Neuroscience, 34*, 15997–16008. https://doi.org/10.1523/JNEUROSCI.1676-14.2014

Skerry, A. E., & Saxe, R. (2015). Neural representations of emotion are organized around abstract event features. *Current Biology, 25*, 1–10. https://doi.org/10.1016/j.cub.2015.06.009

Skerry, A. E., & Spelke, E. S. (2014). Preverbal infants identify emotional reactions that are incongruent with goal outcomes. *Cognition, 130*, 204–216. https://doi.org/10.1016/j.cognition.2013.11.002

Smith, M., & Walden, T. (1998). Developmental trends in emotion understanding among a diverse sample of African-American preschool children. *Journal of Applied Developmental Psychology, 19*, 177–197. https://doi.org/10.1016/S0193-3973(99)80035-5

Soken, N. H., & Pick, A. D. (1992). Intermodal perception of happy and angry expressive behaviors by seven-month-old infants. *Child Development, 63*, 787–795.

Soken, N. H., & Pick, A. D. (1999). Infants' perception of dynamic affective expressions: Do infants distinguish specific expressions? *Child Development, 70*, 1275–1282.

Sorce, J. F., Emde, R. N., Campos, J. J., & Klinnert, M. D. (1985). Maternal emotional signaling: Its effect on the visual cliff behavior of 1-year-olds. *Developmental Psychology, 21*, 195–200.

Spielberg, J. M., Forbes, E. E., Ladouceur, C. D., Worthman, C. M., Olino, T. M., Ryan, N. D., & Dahl, R. E. (2013). Pubertal testosterone influences threat-related amygdala-orbitofrontal cortex coupling. *Social Cognitive and Affective Neuroscience, 10*, 408–415. https://doi.org/10.1093/scan/nsu062

Spielberg, J. M., Olino, T. M., Forbes, E. E., & Dahl, R. E. (2014). Exciting fear in adolescence: Does pubertal development alter threat processing? *Developmental Cognitive Neuroscience, 8*, 86–95. https://doi.org/10.1016/j.dcn.2014.01.004

Stein, M. B., Simmons, A. N., Feinstein, J. S., & Paulus, M. P. (2007). Increased amygdala and insula activation during emotion processing in anxiety-prone subjects. *American Journal of Psychiatry, 164*, 318–327. https://doi.org/10.1176/appi.ajp.164.2.318

Steiner, J. E. (1979). Human facial expressions in response to taste and smell stimulation. *Advances in Child Development and Behavior, 13*, 257–293.

Steiner, J. E., Glaser, D., Hawilo, M. E., & Berridge, K. C. (2001). Comparative expression of hedonic impact: Affective reactions to taste by human infants and other primates. *Neuroscience and Biobehavioral Reviews, 25*, 53–74. https://doi.org/10.1016/S0149-7634(00)00051-8

Stolier, R. M., & Freeman, J. B. (2016). Neural pattern similarity reveals the inherent intersection of social categories. *Nature Neuroscience, 19*, 795–797. https://doi.org/10.1038/nn.4296

Strand, P. S., Cerna, S., & Downs, A. (2008). Shyness and emotion-processing skills in preschoolers: A 6-month longitudinal study. *Infant and Child Development, 17*, 109–120. https://doi.org/10.1002/icd.534

Striano, T., Brennan, P. A., & Vanman, E. J. (2002). Maternal depressive symptoms and 6-month-old infants' sensitivity to facial expressions. *Infancy, 3*, 115–126. https://doi.org/10.1207/15250000252828271

Striano, T., Kopp, F., Grossmann, T., & Reid, V. M. (2006). Eye contact influences neural processing of emotional expressions in 4-month-old infants. *Social Cognitive and Affective Neuroscience, 1*, 87–94. https://doi.org/10.1093/scan/nsl008

Sugden, N. A., Mohamed-Ali, M. I., & Moulson, M. C. (2014). I spy with my little eye: Typical, daily exposure to faces documented from a first-person infant perspective. *Developmental Psychobiology, 56*, 249–261. https://doi.org/10.1002/dev.21183

Sullivan, R. M., & Holman, P. J. (2010). Transitions in sensitive period attachment learning in infancy: The role of corticosterone. *Neuroscience and Biobehavioral Reviews, 34*, 835–844. https://doi.org/10.1016/j.neubiorev.2009.11.010

Swartz, J. R., Carrasco, M., Wiggins, J. L., Thomason, M. E., & Monk, C. S. (2014). Age-related changes in the structure and function of prefrontal cortex-amygdala circuitry in children and adolescents: A multi-modal imaging approach. *NeuroImage, 86*, 212–220. https://doi.org/10.1016/j.neuroimage.2013.08.018

Swartz, J. R., Phan, K. L., Angstadt, M., Klumpp, H., Fitzgerald, K. D., & Monk, C. S. (2014). Altered activation of the rostral anterior cingulate cortex in the context of emotional face distractors in children and adolescents with anxiety disorders. *Depression and Anxiety, 31*, 870–879. https://doi.org/10.1002/da.22289

Sylvester, C. M., Smyser, C. D., Smyser, T., Kenley, J., Ackerman, J. J., Shimony, J. S., … Rogers, C. E. (2018). Cortical functional connectivity evident after

birth and behavioral inhibition at age 2. *American Journal of Psychiatry, 175*, 180–187. https://doi.org/10.1176/appi.ajp.2017.17010018

Székely, E., Tiemeier, H., Arends, L. R., Jaddoe, V. W. V., Hofman, A., Verhulst, F. C., & Herba, C. M. (2011). Recognition of facial expressions of emotions by 3-year-olds. *Emotion, 11*, 425–435. https://doi.org/10.1037/a0022587

Tamietto, M., & de Gelder, B. (2010). Neural bases of the non-conscious perception of emotional signals. *Nature Review Neuroscience, 11*, 697–709.

Taylor-Colls, S., & Pasco Fearon, R. M. (2015). The effects of parental behavior on infants' neural processing of emotion expressions. *Child Development, 86*, 877–888. https://doi.org/10.1111/cdev.12348

Thai, N., Taber-Thomas, B. C., & Pérez-Edgar, K. E. (2016). Neural correlates of attention biases, behavioral inhibition, and social anxiety in children: An ERP study. *Developmental Cognitive Neuroscience, 19*, 200–210. https://doi.org/10.1016/j.dcn.2016.03.008

Thomas, K. M. (2001). Amygdala response to fearful faces in anxious and depressed children. *Archives of General Psychiatry, 58*, 1057–1063. https://doi.org/10.1001/archpsyc.58.11.1057

Thomas, K. M., Drevets, W. C., Whalen, P. J., Eccard, C. H., Dahl, R. E., Ryan, M. D., … Casey, B. J. (2001). Amygdala response to facial expressions in children and adults. *Biological Psychiatry, 49*, 309–316.

Trapanotto, M., Benini, F., Farina, M., Gobber, D., Magnavita, V., & Zacchello, F. (2004). Behavioural and physiological reactivity to noise in the newborn. *Journal of Paediatrics and Child Health, 40*, 275–281.

Tzourio-Mazoyer, N., De Schonen, S., Crivello, F., Reutter, B., Aujard, Y., & Mazoyer, B. (2002). Neural correlates of woman face processing by 2-month-old infants. *NeuroImage, 15*, 454–461.

Uljarevic, M., & Hamilton, A. (2013). Recognition of emotions in autism: A formal meta-analysis. *Journal of Autism and Developmental Disorders, 43*, 1517–1526. https://doi.org/10.1007/s10803-012-1695-5

Vaish, A., Grossmann, T., & Woodward, A. (2008). Not all emotions are created equal: The negativity bias in social-emotional development. *Psychological Bulletin, 134*, 383–403. https://doi.org/10.1037/0033-2909.134.3.383

Vaish, A., Grossmann, T., & Woodward, A. (2015). Person-centred positive emotions, object-centred negative emotions: 2-year-olds generalize negative but not positive emotions across individuals. *British Journal of Developmental Psychology, 33*, 391–397. https://doi.org/10.1111/bjdp.12093

van den Boomen, C., Munsters, N. M., & Kemner, C. (2019). Emotion processing in the infant brain: The importance of local information. *Neuropsychologia, 126*, 62–68. https://doi.org/10.1016/j.neuropsychologia.2017.09.006

van den Bulk, B. G., Meens, P. H. F., van Lang, N. D. J., de Voogd, E. L., van der Wee, N. J. A., Rombouts, S. A. R. B., … Vermeiren, R. R. J. M. (2014). Amygdala activation during emotional face processing in adolescents with affective disorders: The role of underlying depression and anxiety symptoms. *Frontiers in Human Neuroscience, 8*, 393. https://doi.org/10.3389/fnhum.2014.00393

Vicari, S., Reilly, J. S., Pasqualetti, P., Vizzotto, A., & Caltagirone, C. (2000). Recognition of facial expressions of emotions in school-age children: The intersection of perceptual and semantic categories. *Acta Paediatrica, 89*, 836–845. https://doi.org/10.1111/j.1651-2227.2000.tb00392.x

Vlamings, P. H. J. M., Goffaux, V., & Kemner, C. (2009). Is the early modulation of brain activity by fearful facial expressions primarily mediated by coarse low spatial frequency information? *Journal of Vision, 9*, 12–12. https://doi.org/10.1167/9.5.12

Vlamings, P. H. J. M., Jonkman, L. M., & Kemner, C. (2010). An eye for detail: An event-related potential study of the rapid processing of fearful facial expressions in children. *Child Development, 81*, 1304–1319. https://doi.org/10.1111/j.1467-8624.2010.01470.x

Vuilleumier, P. (2005). How brains beware: Neural mechanisms of emotional attention. *Trends in Cognitive Sciences, 9*, 585–594. https://doi.org/10.1016/j.tics.2005.10.011

Vuilleumier, P., Armony, J. L., Driver, J., & Dolan, R. J. (2003). Distinct spatial frequency sensitivities for processing faces and emotional expressions. *Nature Neuroscience, 6*, 624–631. https://doi.org/10.1038/nn1057

Wager, T. D., Kang, J., Johnson, T. D., Nichols, T. E., Satpute, A. B., & Barrett, L. F. (2015). A bayesian model of category-specific emotional brain responses. *PLoS Computational Biology, 11*, e1004066. https://doi.org/10.1371/journal.pcbi.1004066

Walden, T. A., & Ogan, T. A. (1988). The development of social referencing. *Child Development, 59*, 1230–1240.

Wallace, S., Coleman, M., & Bailey, A. (2008). An investigation of basic facial expression recognition in autism spectrum disorders. *Cognition & Emotion, 22*, 1353–1380. https://doi.org/10.1080/02699930701782153

Waters, A. M., Mogg, K., Bradley, B. P., & Pine, D. S. (2008). Attentional bias for emotional faces in children with generalized anxiety disorder. *Journal of the American Academy of Child & Adolescent Psychiatry, 47*, 435–442. https://doi.org/10.1097/CHI.0b013e3181642992

Weaver, J. (2015). Map of visual activity in the infant brain sheds light on neural development. *PLoS Biology, 13*, 1–2. https://doi.org/10.1371/journal.pbio.1002261

Weigelt, S., Koldewyn, K., & Kanwisher, N. (2012). Face identity recognition in autism spectrum disorders: A review of behavioral studies. *Neuroscience and Biobehavioral Reviews, 36*, 1060–1084. https://doi.org/10.1016/j.neubiorev.2011.12.008

Weissman, A. S., Chu, B. C., Reddy, L. A., & Mohlman, J. (2012). Attention mechanisms in children with anxiety disorders and in children with attention deficit hyperactivity disorder: Implications for research and practice. *Journal of Clinical Child and Adolescent*

Psychology, 41, 117–126. https://doi.org/10.1080/15374416.2012.651993

Widen, S. C. (2013). Children's interpretation of facial expressions: The long path from valence-based to specific discrete categories. *Emotion Review, 5*, 72–77. https://doi.org/10.1177/1754073912451492

Widen, S. C., & Russell, J. A. (2003). A closer look at preschoolers' freely produced labels for facial expressions. *Developmental Psychology, 39*, 114–128. https://doi.org/10.1037/0012-1649.39.1.114

Widen, S. C., & Russell, J. A. (2008). Children acquire emotion categories gradually. *Cognitive Development, 23*, 291–312. https://doi.org/10.1016/j.cogdev.2008.01.002

Widen, S. C., & Russell, J. A. (2013). Children's recognition of disgust in others. *Psychological Bulletin, 139*, 271–299. https://doi.org/10.1037/a0031640

Wu, M., Kujawa, A., Lu, L. H., Fitzgerald, D. A., Klumpp, H., Kate, D., … Phan, K. L. (2016). Age-related changes in amygdala-frontal connectivity during emotional face processing from childhood into young adulthood. *Human Brain Mapping, 37*, 1684–1695. https://doi.org/10.1002/hbm.23129.Age-Related

Wu, Y., & Schulz, L. E. (2018). Inferring beliefs and desires from emotional reactions to anticipated and observed events. *Child Development, 89*(2), 649–662. https://doi.org/10.1111/cdev.12759

Young, A., Luyster, R. J., Fox, N. A., Zeanah, C. H., & Nelson, C. A. (2017). The effects of early institutionalization on emotional face processing: Evidence for sparing via an experience-dependent mechanism. *British Journal of Developmental Psychology, 35*, 439–453. https://doi.org/10.1111/bjdp.12185

Young-Browne, G., Rosenfeld, H. M., & Horowitz, F. D. (1977). Infant discrimination of facial expressions. *Child Development, 48*, 555–562.

Yrttiaho, S., Forssman, L., Kaatiala, J., & Leppänen, J. M. (2014). Developmental precursors of social brain networks: The emergence of attentional and cortical sensitivity to facial expressions in 5 to 7 months old infants. *PLoS One, 9*, e100811. https://doi.org/10.1371/journal.pone.0100811

Through the Looking Glass: Temperament and Emotion as Separate and Interwoven Constructs

Koraly Pérez-Edgar

Abstract

The current chapter reviews the theoretical and empirical forces that have shaped the study of emotional development from the perspective of temperament research. Despite variations in the theoretical perspective used to approach the link between temperament and emotion, the necessary limits in available methodologies have drawn the literature to a fairly close empirical consensus. To organize the discussion, the chapter examines four factors that have both led empirical research and have colored subsequent theoretical interpretations: Person, Context, Time, and Experience. Assessing permutations in each of the factors can help the field better understand the complex patterns of emotion development that reflect, and are embedded in, variations in temperament over time. The systematic inclusion of individual differences in each of the four factors also moves the field away from the difficult task of trying to capture the elusive "average child." This strategy may improve our understanding of temperament and emotion development and advance our overarching goal of improving the robustness of our science.

K. Pérez-Edgar (✉)
The Pennsylvania State University, Department of Psychology, University Park, PA, USA
e-mail: kxp24@psu.edu

There are three hard truths in the study of emotion and emotion development. First, the emotions we feel are often more complex than the emotions we express. Second, the form and function of an emotion can shift dramatically across development (time) and space (context). Third, the very nature of what we call an emotion can shift as we shuffle through the operational definition of interest from behavior (e.g., facial expression) to language (e.g., self-report), to activity (e.g., withdrawal), and to biology (e.g., neural circuitry activation). Much of the "core" emotion literature has grappled with how best to deal with this inherent complexity and diversity. It is no surprise, then, that the struggle also spills over to the temperament literature.

Studying temperament in the context of emotion is both a daily occurrence for temperament researchers and a seemingly unattainable goal. That is, 30 years of theory and research has intertwined temperament and emotion, binding the two together at the conceptual, empirical, and methodological level. This entanglement then triggers several questions: When does emotion end and temperament begin? Or, is it that temperament helps define emotion? Or, is it that emotion is the foundation of temperament? Or, yet again, is it that emotion plays no fundamental role in temperament, but is only an ancillary marker of temperament?

Although there are ongoing arguments as to whether temperament and emotion are

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_7

theoretically separable (Bowman & Fox, 2018), they are practically intertwined (Bates, Goodnight, & Fite, 2008). This is partially driven by an overlap in definition, methodology, and construct of interest. In addition, the literature has tended to focus on aspects of temperament most closely aligned with emotional expression. Broadly, the most basic, and agreed upon, definition of temperament is that it encompasses a constellation of traits that are (1) early emerging, (2) biologically based, and (3) multidimensional (Fu & Pérez-Edgar, 2015; Goldsmith et al., 1987; Shiner et al., 2012). Thus, temperament can encompass a wide range of socioemotional and behavioral profiles. Yet, we see many more temperament papers attempting to capture variation in negative affect (Braungart & Stifter, 1991) versus, for example, variation in activity level (Saudino & Eaton, 1991). This is especially true for research traditions that focus on the frequency and intensity of specific basic emotions as the definitional marker of temperamental variation (Goldsmith & Campos, 1986).

The current chapter examines the role temperament may play in helping understand variation in emotion development. As already noted, this question is complicated by our definitional debates on how to best distinguish the constructs—assuming of course that we can or should make this distinction. To provide some structure, the main parts of the chapter are organized around four constructs that reflect the developmental reach of temperament and emotion: Person, Context, Time, and Experience. With a nod to Bronfenbrenner (Bronfenbrenner & Morris, 1998), each construct allows us to examine multiple levels of analysis in understanding the emotional life of a child, in light of evident temperamental variation. First, the chapter addresses some of the broader issues that shape specific constructs of interest.

The Problem at Hand

Decades of research has puzzled with how to best define the emergence and evolution of emotion, beginning in infancy. Much of this work has focused on outlining theoretical and empirical operations of emotion and emotion regulation, striving to describe universal axioms (Pérez-Edgar & Hastings, 2018). However, variations in emotional reactivity, often temperament-linked, are patently evident in the first months of life. Within a relatively short period of time, self-directed attempts to regulate emotion also emerge, and variations in the deployment and efficacy of regulatory mechanisms are also temperament-linked. Adding another layer of complexity is the fact that early on in life outside forces, often caregivers act as external regulators of the child, shaping emotion and behavior to reflect both the caregiver's ideals and broader cultural norms.

What Are We Studying?

Ostensibly, the goal of temperament research is to characterize the dynamic child, in context, as they actively engage in their own development to support change over time across multiple levels of functioning (Overton & Molenaar, 2015). However, if we define temperament research not by the goal, but by the actual approaches taken, the picture shifts a bit. Temperament research, as a science, tends to take static snapshots at a moment in the child's life. With accompanying measures, researchers hope to approach an accurate portrayal of the child's traits and tendencies across a wide range of environments. If researchers are lucky, they will be engaged in a longitudinal study, so that they may follow up the same children over the course of development. However, even here, researchers rely on a series of static snapshots that can be strung together to create an approximation of change over time—much like the old-fashioned kinetoscope before the advent of modern film technology (Dickson & Dickson, 2000). This is not to say that these herky-jerky pictures of development are not important. Indeed, the sections that follow argue that the element of time is pivotal to allowing for a more dimensional view of emotion in the context of early temperament.

Traditionally, the broader field has strived to capture and describe nomothetic rules for emotion development, creating universal laws that can be widely applied without regard to the four constructs of interest (MacNeill & Pérez-Edgar, in press). In this way, psychology has strived to emulate the "hard sciences" with algorithms, laws, and unifying theories (Pérez-Edgar & Hastings, 2018). However, attempts to impose this approach on development have rarely been successful, except in the case of very basic and hard-wired mechanisms (e.g., vision). However, even in this case, we see that variation in time and experience can alter even early emerging sensory mechanisms (Greenough, Black, & Wallace, 1987).

In the case of emotion and temperament, this approach is even less successful. Indeed, the very study of temperament is a rejection of the notion that nomothetic or universal laws can capture variation in children's subjective responses to seemingly stable objective circumstances. Thus, temperament embraces an idiographic approach, tasked with describing, accounting for, and predicting variation within and across individuals and the environment (Overton & Molenaar, 2015). This approach cuts across the multiple components of temperament (e.g., activity), although here we focus on emotion and emotion regulation.

A temperament approach distinguishes itself from other associated fields, focusing more specifically on emotional or social development, by placing emotion within a constellation of complex traits and events. For example, Calkins and Fox (2002) noted that frustration in the laboratory at 6 months is coupled with decreases in attention, increases in activity levels, and poor physiological regulation. From another temperament tradition, the difficult baby shows increased activity, increased negative affect, decreased adaptability, and decreased soothability (Degnan, 2017). Researchers can then layer on individual differences in the form and efficiency of competing strategies that children bring to bear on their initial emotional response (Davis, Levine, Lench, & Quas, 2010).

What Is the Relation Between Temperament and Emotion?

In large part, this question is central to the entire discussion in this chapter. However, to begin, this subsection touches on some of the central points of view which, in turn, implicitly shapes the research and data noted below. Other chapters in the current handbook more directly and thoroughly examine the theoretical approaches to emotion development (see Buss, Cole, & Zhou, Chap. 2, this volume).

An initial starting point is to view emotion as a self-organizing mental system that reflects and regulates the motivation-related aspects of our actions (Holodynski & Friedlmeier, 2006). Since emotion is a continuous, ongoing stance in dealing with the world, emotions will change in relation to actual or perceived significance for well-being or the goal at hand (Cole, Lougheed, & Ram, 2018). Emotions also provide our primary appraisals of the world. As such, they are highly conserved (Bates et al., 2008) and create a foundation of basic emotions (e.g., fear, anger) that can be studied across animal and human models (Capitanio, 2018; Cavigelli, 2018).

Initially, emotional displays, which researchers *assume* reflect the experience of emotion, are triggered by discrete and acute stimuli, both internal and external to the child. Typical development then produces a dissociation between emotion expression and emotion feeling, such that emotions can function as both phenomenological experiences and communicative tools (Holodynski & Friedlmeier, 2006). Temperament researchers are interested in each component of emotional functioning.

One temperament-linked approach to emotion explicitly ties temperament, by definition, to operationalizations of emotion. That is, temperament is defined and delineated by individual differences in the expression and intensity of emotion. As such, temperament is studied in contexts designed to elicit a specific profile of emotions (Goldsmith & Campos, 1982, 1990). This perspective can be characterized by the assumption that temperament is latent and behavior, in

this case, emotion, is the observed expression of the underlying trait. Ironically, this perspective buts up against the view of emotion researchers that emotion itself is latent, and emotion researchers use the physical embodiment as the observed markers. Thus, the same behaviors are used to examine two different constructs, as if the researchers were standing on opposite sides of a plate of glass.

In contrast to the approach binding temperament to emotion, Bowman and Fox (2018) made the clear declaration that "emotion is not a core feature of temperament." Their argument is that tying temperament to a specific emotion is too constricting. For example, one can focus on the temperament trait Behavioral Inhibition (BI, discussed below, Kagan, 2016, 2018b). Central to BI is an early appearing sensitivity to threat, novelty, and reward, as well as the strategy children use to regulate this reactivity. If you focus on these behaviors, you need not *necessarily* invoke emotion to characterize the child's temperamental profile. Rather, you may examine motor activity, patterns of attention, and higher order patterns of approach and withdrawal (Bowman & Fox, 2018). Under this formulation, affect in isolation is not a clear index of temperament.

On a practical level, the approach to characterizing temperament is quite similar across the two perspectives. That is, the typical empirical study of temperament couples emotion systems (affect and its regulation) with motivation systems (the tendency to approach or withdrawal) in the context of a putative trigger. Thus, anger would be characterized as the tendency to show negative affect and approach in the face of goal blockage. In contrast, fear would be characterized as the tendency to show negative affect and withdrawal in the face of a potential threat. Researchers are also equally (sometimes more so) interested in the atypical patterns in which sadness is shown during an anger episode, or fear is shown during a joy episode. These atypicalities suggest individual variation in how infants are interpreting and responding to the individual episodes that are at odds with the "objective" valuation of the events from the researcher's perspective. In addition, profiles of responses across episodes (a variation of time) can help draw out previously unidentified temperamental profiles (Buss, 2011).

For example, the typical BI paradigm refined by Kagan (García Coll, Kagan, & Reznick, 1984) and Fox (Fox, Henderson, Rubin, Calkins, & Schmidt, 2001) averages across emotion- and behavior-eliciting episodes designed. These episodes are quite similar to the procedures created from the Goldsmith approach to the temperament-emotion link (Buss & Goldsmith, 2000). In particular, they both share a structure of individual episodes meant to elicit specific responses. In the case of BI, the focus is on negative affect and behavioral withdrawal in the face of social and nonsocial novelty. Typically, these variables are measured across episodes, and individual scores are averaged. Children who score high in the composite (top 15%–20%) are designated as BI.

Building on this foundation, Buss and colleagues (Buss et al., 2013) instead examined profiles of response across episodes. In doing so, they extracted a subgroup of children that show yet another temperamental profile, dysregulated fear (DF). The BI child may show a relatively similar pattern of response to the episodes (more withdrawal particularly scary episodes, less withdrawal when threat is low) but have overall higher means due to the intensity and frequency of the response. In comparison, the DF child will show high levels of fear and withdrawal even in low-threat episodes.

Which Emotions Do We Study?

Developmental mechanisms, both internal to the child and provided by the caregiving environment, are thought to work in tandem to support adaptive emotional development. The working assumption for "good" development is that you will see a decrease in the frequency and intensity of emotional reactions over time (Holodynski & Friedlmeier, 2006). This is particularly true for negative emotions (e.g., anger and sadness) that are viewed as personally and socially disruptive. At the same time, we expect, and foster, the emergence of new, pro-social emotions, such as empathy.

The specific constellation of emotions that predominate in the temperament literature, as opposed to associated research traditions also interested in emotions, arises from the fact that researchers are interested in an emotion not simply for the sake of understanding its form or function in isolation but as a marker and mechanism for downstream consequences that permeate a host of socioemotional and cognitive domains. In addition, temperament research is often predicated on capturing individual differences evident in the first months of life (Fox, Snidman, Haas, Degnan, & Kagan, 2015). The infant's limited behavioral repertoire effectively guarantees that researchers will focus on basic active states and gross motor patterns. Hence, the practical constraints bring temperament studies closer together in practice, even if they differ in theoretical foundation (Bowman & Fox, 2018; Kagan, 2016). Thus, methodologies typically used in temperament research cut across theoretical considerations.

First, there is a focus on identifying change and continuity over time. Researchers must rely on measures that can be used across a wide developmental window that are both age-appropriate and target the construct of interest. This can greatly limit the scope of potential measures and tasks. As a result, although the target behaviors are similar across studies (e. g., smiling, crying, self-soothing), the interpretation of the behavior is influenced by the researcher's theoretical orientation.

Second, temperament research has drawn from a cognitive and neuroscientific tradition that looks to processes, such as attention (Nozadi et al., 2016; Pérez-Edgar, Taber-Thomas, Auday, & Morales, 2014), tied to neural regions, such as the amygdala (Blackford, Clauss, & Benningfield, 2018; Jarcho & Guyer, 2018), to highlight pathways that support emotion processing. This reflects the core agreement that temperament traits are biologically based and often reflect variation in mechanisms reflecting reactivity and regulation (Rothbart, Ellis, & Posner, 2004). Again, the requirements of task (e.g., computerized stimulus presentation) and measure (e.g., magnetic resonance imaging, MRI) constrains how researchers approach questions of interest. A core concern in this line of work is whether these measures capture processes associated with emotion processing, as opposed to the subjective experience of emotion. Both are vital to emotion development, but they are not interchangeable.

Third, temperament research has drawn from behavioral neuroscience and psychobiology traditions that focus on animal research, often with the direct manipulation of potential circuits. Most often, these studies focus on rodent (Cavigelli, 2018) and nonhuman primate models (Capitanio, 2018; Fox & Kalin, 2014). When building on this literature, researchers interested in human development will by virtue of the underlying models take away evidence targeting discrete emotion patterns that are evolutionarily conserved and typically thought to impact survival value. Ironically, until recently, there was little focus on *development* within the animal literature (Capitanio, 2018).

Building on a foundation of animal studies tends to push the field toward studies of fear, distress, and anger (Rothbart et al., 2001). Negative emotions are typically examined at a relatively granular level in which discrete stimuli are linked to a circumscribed emotional response. For example, the presence of a snake is linked to withdrawal and a fear response in naive monkeys (Nelson, Shelton, & Kalin, 2003). In contrast, many of our prototypes for positive emotion, such as joy or pleasure, are difficult to operationalize in nonhuman models. In addition, positive emotions are often interwoven with complex social processes, such as affiliation and attachment, which may be even more difficult to translate. As a further complication, these constructs are inferred in the ability to engage in socially competent interactions, creating the risk for circularity (Cavigelli, 2018).

Thus, although the varying temperament traditions described below vary in their approach to, and definition of, the temperament-emotion relation, practical forces often blur theoretical distinctions. The desire to capture processes that are (1) identifiable early in life; (2) trackable over time; (3) reflected in biology, thought, and behavior; and (4) traceable to evolutionarily conserved

forces binds these traditions together, by necessity, to a relatively constrained set of measures that best fit some, but by no means all, of our targets. As a result, the review of the literature noted below will reflect a great deal of overlap in outcome, if not in motivation. In the end, the source of information available to us will constrain how we characterize and capture stability and change (Brownell, Lemerise, Pelphrey, & Roisman, 2015). The data generated by the temperament literature is also bound by a common "enemy": attempting to disentangle the form and function of emotion from the embedded mechanisms of emotion regulation.

Are We Studying Emotion or Emotion Regulation?

First, researchers need to ask if this is even a legitimate question. For example, Campos, Frankel, and Camras (2004) argue that emotion and emotion regulation are functionally inseparable. That is, we may phenomenologically sense the initial feeling of an emotion (e.g., fear in the face of a furry spider), followed by subsequent regulation (e.g., self-talk pointing out that the specimen is indeed harmless). However, this perspective argues that no emotion is ever "pure," existing in an unregulated state. In infancy, often a target of temperament research, researchers may have a better chance of seeing the initial reactive burst of emotion to a stimulus trigger. Even here, however, unconscious mechanisms of regulation may be automatically triggered with the very experience of emotion (Campos et al., 2004).

It may be that humans are pre-wired to engage in regulatory, if unconscious, processes, particularly when embedded in a social context. For example, the intraindividual stress contagion is evident in the earliest months of life (Wass, Clackson, & Leong, 2018). You can see infants thumb-sucking in response to another infant's cry (Geangu, Benga, Stahl, & Striano, 2011), laying the foundation for socially mediated emotion and emotion regulation. Over time, more sophisticated emotion regulation is seen in a shift from action to cognition, which reflects a broader underlying developmental progression (Perry & Calkins, 2018).

While most researchers agree with the practical difficulty in disentangling emotion from emotion regulation, strategies of attack have been formulated to help loosen some of these binding threads (Cole, Martin, & Dennis, 2004). Here, the focus is on temporally sensitive measures and repeated assessment of infants' emotional experiences (Cole & Hollenstein, 2018). Establishing the construct validity for emotion regulation strategies (e.g., based on behavioral and/or physiological correlates) relies on the assessment of consecutive changes in emotion-linked biological markers, behaviors, and expressions over time (Buss & Goldsmith, 1998; Cole et al., 2004; Fox, Kirwan, & Reeb-Sutherland, 2012). Multiple levels of analysis are needed as researchers cannot assume that they will all modulate in the same way over the course of assessment (Morris, Robinson, & Eisenberg, 2006).

Our ability to capture regulation is also tied to the child's ability to regulate with development. Capturing an elusive construct is all the more difficult when its presence is unstable, fleeting, and often ineffective. To outline the steps of emotional self-regulation, McClelland and colleagues (McClelland, Geldhof, Cameron, & Wanless, 2015) suggest researchers can look to see if the child is engaging in three orderly steps: (1) Take in information, (2) weigh choices and their consequences, and (3) make an adaptive choice in order to move closer to the goal. If we first look at infancy as the emergence of self-regulation (Sheese, Rothbart, Posner, White, & Fraundorf, 2008), researchers can often capture number 1 but are unlikely to see a systematic attempt at number 2. In addition, while researchers often see action and reaction on the part of the infant to a stimulus, they cannot necessarily infer the element of choice typically implicated in number 3. Over time, the expectation is that children will be better able to generate and sift through regulatory choices (Davis et al., 2010) and engage in active selection, making each individual step more easily discernible. These regulatory responses can then be assessed as a dynamic process that

monitors and evaluates emotion in light of the child's overarching goal (Perry & Calkins, 2018).

Regulation reflects the tension between the child's probable response in the face of an event within a context and the strategies that the child will use to modulate that response, again in light of the event and its context (Cole, Bendezú, Ram, & Chow, 2017). If the emotions are not deemed to need regulation, regulatory mechanisms are likely to lie dormant. If the child's probable response does not match the needs of the moment, attempts at regulation are more likely to emerge. If the emotion is overwhelming and pressing, then any regulatory attempts may be difficult to capture, simply because they are woefully ineffective.

The tension between emotion and regulation generates within and between child variation in the pattern of coupling between the child's prepotent emotional response and the regulatory processes, executive and automatic, that are then brought to bear. One can think of emotion regulation as a physical system with location, velocity, and acceleration (Morales et al., 2018). The system works to return to its homeostatic set point. Large variation from the set point will prompt the system to engage regulatory mechanisms. Over time, less dramatic deviations from the set point, coupled with more effective counter measures, produces the phenotypic presentation of greater stability in emotionality with development.

Temperament impacts the profile and context of emotion generated. For example, a temperamentally reactive child confronted with a threat may experience, and express, an acute fear response. This initial response then impacts the intensity and form of regulation needed by the child (Stifter, Dollar, & Cipriano, 2011). There may then be temperament-linked differences in the ways in which children regulate and the efficacy of the regulation strategy. For the youngest of children, regulation is socialized in that caregivers lead (e.g., distraction) or scaffold (e.g., coach the child) implemented strategies. Given that extreme temperaments (e.g., BI) are often marked by a relative inability to smoothly engage in social interactions, this may add an additional wrinkle in the child's ability to practice and internalize socially mediated regulatory strategies (Zalewski, Lengua, Wilson, Trancik, & Bazinet, 2011).

These foundational issues highlight the complexity of examining temperament as biologically based variations in how children engage with their environments. Variations are marked by evident differences in emotion and emotion regulation, although there is disagreement regarding how to classify these constructs as antecedent, consequence, or proxy to temperament. As noted above, this chapter is organized to highlight four constructs that may help underscore our understanding to date and note evident gaps for future study: Person, Context, Time, and Experience. The first section, Person, will be the longest as it most directly reflects the focus on individual differences at the core of the temperament literature (Kagan, 2018b; Pérez-Edgar & Hastings, 2018). In addition, this section will briefly lay out the most prominent historical approaches to temperament and emotion (for an additional discussion, see Fu & Pérez-Edgar, 2015; MacNeill & Pérez-Edgar, in press).

Person

How do we capture temperament? Often, the focus is on the person, with little sense of other moderating factors. That is, both in and out of the laboratory, researchers tend to focus on the traits and behaviors "carried" by the individual child. First, there are natural observations of the child as they interact with the environment, caregivers, and peers. Sometimes, these are solitary observations—the child approaches and attempts to climb the highest slide in the playground. Researchers note if, and how long, it took to get the child up the stairs and down the slide. However, most of what researchers typically focus on is dyadic or social in nature (Henderson, Green, & Wick, 2018; Rubin, Barstead, Smith, & Bowker, 2018). The child may or may not receive bids to play from peers. The child may or may not have a caregiver that approves of his affective displays. One difficulty with this approach is that the researcher cannot assess the formal function

of an emotion in the absence of a clear signal of the emotion, or in the absence of a situational trigger likely to pull for a specific emotion. For example, researchers cannot capture variation in the emotional response to social exclusion if social exclusion does not actually occur during the observation window (Howarth, Guyer, & Pérez-Edgar, 2013; Morales, Vallorani, & Pérez-Edgar, 2019; Rubin, Hymel, Mills, & Rose-Krasnor, 2014).

In the alternative, researchers bring the child to the laboratory, so that they may tightly control the experiences of the child and our ability to capture the accompanying response. Thus, researchers can film the child and later code his behavior for direction (approach vs. withdrawal), intensity, speed, and valence. This type of research is often coupled with physiological measures in the moment (Buss, 2011; Lunkenheimer et al., 2015). As such, there is added insight into the biological mechanisms that accompany (and perhaps generate) observed emotion and behavior. Indeed, given the rapidity with which regulatory processes are called into play, researchers often rely on psychophysiology to reveal hidden threads of temperament that are not evident behaviorally. Of course, multiple methods often generate multiple time courses and multiple profiles of activity, each of which complicate our understanding of a child's temperament (Morris et al., 2006). This is not necessarily a bad thing, given that a static unidimensional view of temperament often fails to capture individual trajectories or help predict outcomes of interest.

Researchers then often ask outside observers to weigh in. Rothbart (2012), for example, has designed a series of questionnaires that can follow a child from the first months of life—the Infant Behavior Questionnaire (IBQ)—firmly into adulthood—the Adult Temperament Questionnaire (ATQ). Of course, as with any questionnaire, it must use observable behavior (physical or verbal) to characterize the child. As the child ages and presumably becomes both more verbal and self-reflective, self-report versions, such as the Early Adolescent Temperament Questionnaire (EATQ), are used. The shared structure of the questionnaires also helps alleviate the concern that studies of temperament do not hold constant the item of measurement over time (see below).

Finally, temperament researchers turn to focus on biological markers as a central source of information. Biological measures are noted last since there are typically the least commonly used across the literature and limited to laboratory-based studies (Pérez-Edgar & Bar-Haim, 2010). Their relative lack of use is quite understandable at the practical level since many times the needed equipment is expensive and requires extensive training (e.g., MRI). From a theoretical level, however, this is a surprising imbalance in the empirical evidence since the very definition of temperament specifies that the traits of interest are biologically based (Fox, Henderson, Pérez-Edgar, & White, 2008). In addition, biologically based measures may help researchers disentangle socioemotional patterns based on temperament (e.g., dysregulated fear; Buss & Kiel, 2013) from phenotypically similar behaviors that may be acquired via other mechanisms (e.g., fear conditioning; Reynolds, Askew, & Field, 2018).

Thus, an inherent difficulty of the temperament literature is that researchers all tend to study temperament *backwards*. Researchers define the construct as biologically based tendencies that shape observed behavior but typically measure behavior, through either direct observation or questionnaire report, and then go in search of the biological basis. To date, none of the typically studied temperamental profiles or continuums are *defined* by the presence or absence of a specific biologically based measure.

Naturalistic observations, laboratory-controlled paradigms, questionnaires, and biological measures are the basic building blocks of temperament research. However, they have been used in unique ways to create individual models of temperament—each focused on the traits embodied by the individual child. These traits are then juxtaposed against the other developmental factors (e.g., Context, Time, and Experience) that are thought to shape long-term trajectories. Here is a brief summary of some of the leading models that have shaped temperament research to date.

The Thomas and Chess Approach

The New York Longitudinal Study (NYLS) stands as a landmark in the field of temperament research (Thomas & Chess, 1977), characterizing temperament across nine dimensions: activity level, regularity, approach-withdrawal, adaptability, threshold of responsiveness, intensity of reaction, quality of mood, attention span/persistence, and distractibility. Children are categorized as "difficult," "easy," and "slow to warm" types on the basis of their scores on each dimension. Moreover, Chess and Thomas introduced the concept of "goodness of fit" to describe the temperament-environment interplay and its link to adjustment. It is important to note that the characterization of difficult or easy was not solely born by the child but by his or her match with the environment. For example, Dennis (2006) showed that children demonstrated better emotion regulation, marked by low frustration and high persistence while waiting to open an attractive gift, only when children and their mothers both shared high levels of temperamental approach.

The Buss and Plomin Approach

Buss and Plomin (1975, 1986) proposed a behavior genetics-oriented model of temperament, proposing that temperament traits have an early onset and are inherited, evolutionary adaptive, present in nonhuman animals, relatively stable during development, and predictive of later behaviors in adulthood. They identified three core dimensions: (1) emotionality (E), the tendency to become upset easily and greatly (considered as equivalent to distress); (2) activity (A), which contains the components of tempo and vigor; and (3) sociability (S), defined as the preference for others' company and the tendency to engage in social interactions. In the model, temperament dimensions undergo quantitative changes in their mean levels over time, while the underlying structure of temperament remains stable.

The Goldsmith Approach

Goldsmith and Campos (1982, 1986) defined temperament as individual differences in the propensity to express and experience primary emotions (e.g., joy, anger, and fear, Goldsmith & Campos, 1982, 1986) restricted their definition to infant temperament, in order to obtain a relatively "pure" conceptualization of temperament expressions that are not mediated by socialization influences and cognitive processes. The initial definition is also behaviorally oriented, as behavioral expressions impact infants' interactions with their environments and can provide a starting point to understanding the biological underpinnings of temperament (Goldsmith & Campos, 1982). As noted above, Campos et al. (2004) argue that emotion expression and regulation might not be separable, as the observed emotion outputs are likely to have been processed by preexisting regulatory functions, even in infancy. This approach has had a strong empirical impact across theoretical approaches via the Toddler Behavior Assessment Questionnaire, TBAQ (Goldsmith, 1996), and the age-adapted Laboratory Temperament Assessment Battery (Lab-TAB; Buss & Goldsmith, 2000; Goldsmith & Gagne, 2012; Goldsmith & Rothbart, 1993).

The Rothbart Approach

The Rothbart model (Rothbart & Derryberry, 1981) provides a more inclusive conceptualization of temperament than the previously reviewed approaches. This model defines temperament as biologically rooted individual differences in reactivity and self-regulation in emotional, activational, and attentional processes. Taking a dimensional approach, each of the three higher-order dimensions is comprised of several lower-order temperament traits (Rothbart & Bates, 2007). Questionnaire measurements under this approach assume heterotypic continuity in temperament development. That is, phenotypic manifestations of a temperament trait may vary across time, but the underlying biological profile

is constant (Caspi, 1998). As presented in Rothbart and colleagues' age-specific questionnaires, the broad dimensions remain stable, but the specific traits indexing each dimension changes across age groups. For example, effortful control during early infancy is measured as a form of involuntary attention orienting. As more voluntary forms of control develop later in life, indices of effortful control come to also encompass attention shifting and focusing (Rueda, 2012).

The Rothbart model is unique among the reviewed approaches in prominently placing regulation as a core component of temperament. These capacities first emerge at the end of first year of life and continue to improve during late childhood (Rothbart & Bates, 2007). For example, the ability to detect errors is observable as early as 7 months of age (Berger, Tzur, & Posner, 2006). Toddlers begin to show good executive attention functions in a spatial conflict task at 2.5 years old, and their ability to resolve conflicts steadily improves between 4 and 7 years (Rueda, 2012).

In addition to maturational changes in biological processes subserving negative affect and surgency, observed changes are also directly associated with the growing influence of effortful control on behavior. As effortful control develops during toddlerhood, it facilitates voluntarily shifting attention away from distressful stimuli, inhibiting impulses, and increasing self-monitoring of behavior. As a result, it exerts "brakes" on unregulated negative emotionality and motor activities (Derryberry & Rothbart, 2002) and enhances children's coping strategies and abilities to adapt to environmental demands. Longitudinal data indicate that higher effortful control predicts fewer experiences of negative emotional arousal, and conversely, elevated negative emotionality predicts lower effortful control efficiency (Eisenberg, Spinrad, & Eggum, 2010). As such, it is the continued dynamic and reciprocal interactions between temperamental reactivity and regulation that contribute to observed instability of temperament expression over time (Rothbart & Bates, 2007).

The Kagan Approach

Distinct from approaches that hold a dimensional view of temperament, Kagan and colleagues defined behavioral inhibition (BI) as a temperamental *category* characterized by discrete biological dispositions marked by high psychophysiological reactivity coupled with hypervigilance and behavioral withdrawal upon encountering novel people, objects, and events (Kagan, Reznick, Clarke, Snidman, & García-Coll, 1984). Elevated negative reactivity toward novelty can be observed as early as 4 months (Kagan, 1994). Research on BI focuses on examining the stability of BI and the relation between BI and internalizing symptoms (especially anxiety problems) over time (Kagan et al., 2007).

Kagan's approach emphasizes the use of behavioral observations and biological measures, rather than parent-report questionnaires, to study temperament (Kagan, 2018b). Based on laboratory observations, 4-month-old infants who displayed elevated motor reactivity and distress toward novel visual and auditory stimuli were categorized as "high reactive" (Kagan & Snidman, 1991) or "high negative" (Fox et al., 2001). BI in young children (from 14 months to before 48 months of age) is examined by coding their latencies to approach and interact with unfamiliar people and objects and an experimenter. Assessment in older children (4 years to school age) focuses on how they play and interact with unfamiliar peers. Hence, Kagan's approach also focuses on heterotypic continuity of temperament development over time (Fox et al., 2001).

Grounded in cross-species research on the neurobiology of fear responses (LeDoux & Daw, 2018), Kagan's construct of BI (Kagan, 2016, 2018b) is the most explicit example of tying the phenotypic expression of a temperament trait with its presumed underlying psychobiological mechanism. He proposed that the neurobiological foundation of BI is rooted in a highly excitable amygdala, which predisposes children to become hypervigilant toward unfamiliar stimuli (Kagan, 2012; Kagan, Reznick, & Snidman, 1988), as well as contributes to the development and stability of BI (Fox, Henderson, Marshall,

Nichols, & Ghera, 2005; Kagan et al., 1988). A series of neuroimaging studies indicate that adults who were identified as "high reactive" at 4 months showed greater amygdala responses when presented with neutral unfamiliar faces compared to those who had been "low reactive" (Schwartz et al., 2012; Schwartz, Wright, Shin, Kagan, & Rauch, 2003). Moreover, Pérez-Edgar and colleagues (Pérez-Edgar et al., 2007) found that, compared to noninhibited adolescents, adolescents with sustained BI in childhood showed elevated amygdala response while rating how afraid they were of emotional and neutral faces. The behaviorally inhibited adolescents also showed greater amygdala activation in task conditions involving uncertainty (i.e., rating fearfulness to happy faces). The hyperresponsive amygdala is also likely to mediate the stability of BI, as the amygdala has extensive connections to cortical areas that contribute to behavioral avoidance and deficient safety learning observed in behaviorally inhibited individuals (Schwartz et al., 2012; Sylvester & Pine, 2018).

Stable BI across childhood is a risk factor for anxiety disorders, especially social anxiety disorder (SAD; Pérez-Edgar & Fox, 2005). BI and anxiety disorders have a range of overlapping behavioral, cognitive, and neurological features, including social withdrawal, attention bias to novelty and potential threats, high baseline cortisol levels, and amygdala hyper-reactivity (Degnan, Almas, & Fox, 2010). A recent meta-analysis of prospective longitudinal studies suggested that risk for SAD increases sevenfold for behaviorally inhibited children (Clauss & Blackford, 2012). However, BI is unlikely to simply be an early manifestation of anxiety disorders (Pérez-Edgar & Guyer, 2014). First, the functional impairments and hypersensitivity to social evaluations associated with SAD are not defining features of BI (Blackford et al., 2018; Clauss & Blackford, 2012). Second, there is only moderate continuity of BI from infancy through childhood, with correlations between testing waves in longitudinal studies ranging from 0.18 to 0.52. Clauss and Blackford (2012)'s meta-analysis revealed that only 43% of behaviorally inhibited children developed SAD. The considerable degree of discontinuity suggests that BI should be considered as a construct distinct from anxiety disorders.

The central tenet of Kagan's approach argues that early BI does not necessarily predict stability of temperament and later anxiety disorders (Pérez-Edgar & Fox, 2018). Rather, it constrains possible socioemotional development outcomes: The possibility of behaviorally inhibited children *not* becoming exuberant or developing externalizing problems is greater than the likelihood of those children staying behaviorally inhibited or developing anxiety problems (Kagan et al., 2007).

Across each of the summarized research traditions, the focus has initially been the child and his or her place on the spectrum of variation on any one construct of interest. This emphasis is understandable, as temperament research historically stood as a counterpoint to traditions that emphasized the environment, and experience, as the central catalyst for developmental trajectories (Pérez-Edgar & Hastings, 2018). At the most extreme, social learning theorists would argue that environmental inputs, often in the form of rewards and punishments, gradually shape the arc of an individual's life without strong regard to the child's unique constellation of tendencies and abilities (Bandura, 1978). Although these debates were often fierce (Goldsmith et al., 1987; Shiner et al., 2012), it would be just as incorrect to assert that temperamental traits, including the experience, expression, and regulation of emotion, are not sensitive to environmental variation. As such, the next section examines the child in the context of his or her environment.

Context

When researchers discuss the context of development, they can point to the literal place in time and space that that the child's experiences play out (Witherspoon, Daniels, Mason, & Smith, 2016). The context can increase or decrease the likelihood that a child will face specific experiences, modulating the type, intensity, and frequency of inputs that generate temperament-linked responses. For example, a child

born in an area of war and strife is more likely to experience parental loss. For the reactive child, who may show difficulty in creating strong attachment bonds (Fox & Calkins, 1993), this loss may place a greater strain on adaptive compensatory mechanisms, relative to the child deemed more resilient. In the same vein, a child born into an environment that is predictable, well-resourced, and supportive may look much like his or her peers because any underlying "deficiency" in adaptation is never truly tested. These two environments would radically shift both the child's ability to function and the observer's formulation of who that child is as a person. This is because we integrate meaning making for a person as embedded in a context, rather than as an individual in isolation in any one moment in time (Overton & Molenaar, 2015).

The experience-expectant and experience-dependent nature of emotion development suggests that child temperament may modulate both how emotion generation and regulation processes emerge and the extent to which extrinsic contextual and environmental influences shape their emergence. Thus, in addition their unique and independent contributions to emotional development, temperament and contextual forces may interact to determine emerging trajectories. The dynamic interactions between infants' temperament and contextual influences are at the center of diathesis-stress/dual-risk (Klein, Dyson, Kujawa, & Kotov, 2012; Nigg, Goldsmith, & Sachek, 2004) and differential susceptibility (Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2007; Ellis, Boyce, Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2011) models. Both theoretical perspectives suggest that temperamentally negative children display an increased receptivity to environmental influences. Diathesis-stress/dual-risk models primarily focus on the increased vulnerability of temperamentally negative children in the face of environmental or contextual adversity, whereas differential susceptibility models extend the idea of greater sensitivity to supportive and positive contextual influences. These theories propose that temperamentally negative infants are not only affected more by adverse environments, but they also benefit more from supportive environments. Thus, they are open to environmental influences both "for better and for worse" (Belsky et al., 2007).

The current section will first discuss two important markers of context that directly shape the development of emotional experience and regulation: parenting and culture. The third subsection then discusses how we can use context to help examine an important question in the temperament literature, namely, evident patterns in under-, over-, and adaptive regulation. Finally, the last subsection speculates on our ability to examine how the child, as marked by specific temperamental traits and vulnerabilities, acts as a unique context of development.

Parenting

Parenting is among the most extensively studied contextual factors in early development, and its links to children's later socioemotional development and well-being are well established (Kiff, Lengua, & Zalewski, 2011). Parents' positive emotional expressions, and their accompanying synchronous and sensitive responding to infants' emotional expressions, provide the main framework for both the early experience and regulation of emotion (Als, Tronick, & Brazelton, 1979; Cohn & Tronick, 1987; Tronick, 1989). In line with this idea, observational studies consistently find that young infants seem to instantly tune in to changes in their parents' expressions of emotion and their emotional expressions seem to mirror those of their parents during these interactions (Aktar, Bockstaele, Pérez-Edgar, Wiers, & Bögels, 2018; Aktar & Bögels, 2017). Thus, infants are more positive when parents express more positive affect. Additionally, infants express less positive and more negative affect when parents stop responding in these dyadic interactions, such as in the still-face paradigm (Mesman, van IJzendoorn, & Bakermans-Kranenburg, 2009).

Infants' self-regulatory capacity develops within early relationships with caregivers. At first, the parent steps in and *is* the regulatory

response. Thus, when an infant is frightened and cries in response, the parent will often swoop in to remove the offending object, soothe the child, and then turn the child's attention to an appetitive object or behavior (e.g., playing with a toy). Parents who are positive, sensitive, and responsive toward their infants in early interactions are thought to provide the optimal environment for supporting self-regulation. Therefore, the infancy literature typically focuses on parenting dimensions that relate to the early parent-child relationship, such as mutual responsivity, synchrony, attachment security, or to parents' interactive quality such as emotional synchrony, availability, and sensitivity (Kiel & Kalomiris, 2015; Kim, Stifter, Philbrook, & Teti, 2014). Synchrony between parent and infant emotion in early face-to-face interactions, captured in both behavior and physiology, is a key co-regulation process providing the foundation for infants' self-regulatory skills (Feldman, Magori-Cohen, Galili, Singer, & Louzoun, 2011).

Over time, the child will internalize these regulatory structures and move from co-regulation to self-regulation. Of course, the form of this shift will depend on the child's trait-level ability to regulate (person), the types of events they have been confronted with (experience), and the type of regulatory outcomes that are valued and reinforced by caregivers (context). As a result, "sensitive" parenting can only be characterized and defined in the context of the specific child, his or her traits, and the society in which the child must adaptively function in.

Positive aspects of parenting and mutual responsivity in early parent-child relationships seem to be especially beneficial for emotion regulation in children with temperamental difficulties. For example, children who experience more affective synchrony in their emotional expressions during face-to-face interactions with their mother at 3 months and 9 months were found to show better self-regulation at 2 years of age, especially if they have high levels of difficult temperament (Feldman, Greenbaum, & Yirmiya, 1999; Feldman, Greenbaum, Yirmiya, & Mayes, 1996). In a parallel vein, high levels of mother-child mutually responsive orientation at 15 months is related to better self-regulation at 25 months but only for children with high levels of temperamental negative affect (Kim & Kochanska, 2012).

The critical role of parenting in influencing socioemotional development continues from infancy into childhood and adolescence (McLeod, Wood, & Weisz, 2007). The parenting literature highlights the interplay between parenting behaviors and early child temperament (Kiff et al., 2011) to shape functioning over time. As a complex, multifaceted behavior, parenting has been conceptualized in different ways. The current review focuses on two types of parenting behaviors that have been commonly studied in the context of temperament, overprotection and intrusiveness (Rubin et al., 2018). To further constrain this discussion, the focus here is on BI, although parenting behaviors are equally important for other temperamental traits, such as exuberance (Tsotsi et al., 2019) and attention control (Eisenberg et al., 2005).

Overprotective parenting, sometimes labeled as oversolicitous parenting, is conceptualized as parental restrictions on their child's exploration in new environments. Oversolicitous parents often step in to provide excessive comfort to the child, particularly when not warranted (Ungar, 2009). In doing so, parents may inadvertently prevent the child from "practicing" how to experience, and then adaptively regulate, emotion. Inhibited toddlers and preschoolers of overprotective parents tend to show greater stability of behavioral inhibition, and a greater likelihood in showing anxious behaviors, than their equally inhibited peers with less protective parents (Hastings et al., 2008; Rubin, Burgess, & Hastings, 2002). Similar patterns were observed in other parenting behaviors marked by "overly" sensitive or high-warmth parenting. For instance, Mount and colleagues (Mount, Crockenberg, Jó, & Wagar, 2010) found that high levels of maternal sensitivity were correlated with more concurrent anxiety symptoms for inhibited toddlers, relative to their noninhibited peers. Parallel works (Park, Belsky, Putnam, & Crnic, 1997) found that for highly negative reactive infants only, more "supportive" parenting (i.e., higher

sensitivity and lower intrusiveness) during the second and third years of life was correlated with increased inhibited and anxious behaviors at age 3.

Intrusive parenting is defined as parental control over children that commands or constrains children's behaviors (Wood, 2006) and is sometimes been labeled as overcontrol or low autonomy granting (van der Bruggen, Stams, & Bögels, 2008). In the context of behavioral inhibition, intrusive parenting occurs when parents push their children to interact with an unfamiliar situation in a forceful way. Similar to the negative effect of overprotection, behaviorally inhibited children of intrusive parents show higher stability of inhibition and increased risks for later anxiety. For instance, toddlers' inhibited behaviors at age 2 significantly predicted their social reticence at age 4, but only when their mothers showed more intrusive behaviors at age 2 (Rubin et al., 2002).

The detrimental effect of intrusiveness and related parenting behaviors may be due to the fact that it overwhelms children's coping capacities when they are already stressed by the novel circumstances and thus enhances their feelings of being out of control (Chorpita and Barlow 1998). Intrusiveness may also induce in children heightened negative emotional arousal, which may further disrupt their ability to self-regulate (Nachmias et al. 1996). This line of studies suggests that the effects of early behavioral inhibition may be potentiated by variations in parenting behaviors, which color the emotional tone of the child's immediate environment. Interestingly, these two types of parenting behaviors, overprotection and intrusiveness, appear to be quite different from each other. Yet, they show similar effects, perhaps rooted in the fact that children are prevented from effectively facing, and adapting to, novelty across contexts.

In addition to the moderating effects of parenting on the link between behavioral inhibition and socioemotional outcomes, bidirectional relations are also observed between temperament and parenting. That is, while individuals are influenced by the environment, they also play an active role in shaping their environments (Sroufe & Rutter, 1984). These relations are evident in the first months of life but can take on a larger role as children take on greater autonomy to choose and navigate their environments (Davies & Cicchetti, 2004).

In examining the impact of parenting on the child, longitudinal data report that overprotective parenting at age 2 predicted later increases in toddlers' fearful temperament at age 4, above and beyond the stability of children's behaviors over time (Rubin et al., 2002). Similar patterns were observed in studies of preschoolers, where protective parenting predicted children's fearful behaviors a year later, even when accounting for the stability of children's temperamental fearfulness (Edwards, Rapee, & Kennedy, 2010). In another study (Rubin, Nelson, Hastings, & Asendorpf, 1999), however, parents' self-reported overprotective behaviors at age 2 failed to predict parent-reported behavioral inhibition at age 4. Yet, another study with toddlers found that over and above the effect of early temperamental reactivity during infancy, certain "negative" parenting behaviors observed at 27 and 33 months, including lower sensitivity, less positive affect, and greater intrusiveness, predicted decreased inhibited behaviors in children when they were 36 to 37 months old (Park et al., 1997). These longitudinal patterns converge with findings from the interaction studies reviewed above. Overall, parental overprotection tends to worsen the negative impact of behavioral inhibition on mental health outcomes, either by conditioning the effects of behavioral inhibition or fearful temperament on later anxiety or directly leading to increased levels of behavioral inhibition, which in turn confer greater risks for anxiety.

In tandem, there is evidence supporting the impact of temperament on parenting, demonstrating the evocative effects of child temperament in eliciting specific parenting behaviors. Much of this work has focused on the influence of early childhood behavioral inhibition on protective parenting. Specifically, it is conceptualized that inhibited children, compared with their noninhibited peers, may be more likely to elicit overprotection from parents, especially when they show fearful responses to novel and uncertain situations. Longitudinal data suggest that

parental report of toddler's inhibition predicted parents' future overprotection and discouragement of independence, when accounting for the stability of parenting behaviors (Hastings & Rubin, 1999; Rubin et al., 1999). Overprotection may in turn reinforce toddlers' inhibited behaviors and increase the likelihood of developing anxiety, playing a mediating role between early behavioral inhibition and anxious behaviors a year later (Kiel & Buss, 2011). Similarly, in older children, higher levels of fearful inhibition at age 9 predicted increased parental acceptance a year later and modest decreases in parental rejection over the next 2 years, even while controlling for stability of parenting (Lengua & Kovacs, 2005).

Culture

The manifestation and interpretation of emotion is intimately tied with the individual's cultural context. Wang (Chap. 22, this volume; Wang & Brockmeier, 2002) characterizes culture as a system manifested in customs and practices that works to direct and regulate individual and social behavior. In addition, culture provides individuals with communicative symbols, often in the form of specified patterns of emotion expression (Holodynski & Friedlmeier, 2006). Culture's impact on development is widespread, encompassing both expected socioemotional behavior and cognitive processes, such as autobiographical memories (Wang, 2013).

The developmental impact of temperamental openness on environmental input is magnified by the fact that emotions are often the target of parental socialization, with the intent to enhance or minimize specific forms of emotional displays (Denham, Bassett, & Wyatt, 2007). Within western cultures, this often means that parents try to increase the display of positive emotions while minimizing the displays of negative emotions (Chen, Rubin, & Li, 1995; Holodynski & Friedlmeier, 2006). These culturally mediated ideals build on two streams of co-regulation (Chen et al., 1995). One mechanism is often deliberate, as the parent hopes to shape the child's outward expression and experience of emotion to reflect socially acceptable, and age-appropriate, emotional profiles (Sroufe, 1997). At the same time, infants and children may engage in unintended co-regulation, eliciting and triggering emotional responses within the parent which may need to be acted on through enhancement or downregulation, depending on the match with sociocultural expectations. Socialization practices also refine the communicative intent of emotions, supporting culture-specific transformations of expressive reactions into signs that can be used symbolically (Holodynski & Friedlmeier, 2006). These socialization practices begin early in life and are pervasive, such that by age 4.5 years, it is difficult to disentangle the effects of temperament and parenting (Kiel & Kalomiris, 2015; Root & Stifter, 2010).

Beginning as early as infancy, caregivers will shape and mirror acceptable emotions and reinforce preferred emotion regulation strategies (Holodynski & Friedlmeier, 2006). Although infants typically express a fairly standard array of emotional signals early in life, variation is initially introduced with the emergence of temperament-linked profiles of emotion and emotion regulation (Rothbart, Sheese, Rueda, & Posner, 2011). Quickly, however, we see culture-specific transformations of these expressions into socially embedded communicative signs (Holodynski & Friedlmeier, 2006). For children whose initial temperament does not match the cultural ideal, there is an additional pull on emerging regulatory mechanisms to align the individual with social partners. Thus, an open question in the developmental literature centers on the extent to which parents mirror the emotions of their children and then engage in culturally informed regulation of their emotions. Important, as well, is to ask how early in development cultural differences in emotion shaping emerge.

For example, western mothers tend to minimize signs of shyness in children, particularly in boys, but are unlikely to discourage boisterous exuberance (Degnan et al., 2011). In the United States, researchers often note decreases in the phenotypic expression of behavioral inhibition in children over time as parents and

teachers try to draw out the withdrawn child (Almas et al., 2011). In contrast, up until recently, one often saw increases in behavioral inhibition over time in mainland China. This reflects the traditional values of demure or reserved demeanor. Indeed, inhibited children were often held up as leaders in their school community (Chen et al., 1995; Chen, Rubin, Li, & Li, 1999). This pattern is still evident in rural, more traditional, areas of the country. In contrast, behaviorally inhibited children in rapidly urbanizing cities now show the same negative outcomes—shyness, withdrawal, loneliness—seen in the west (Chen, 2010). This shift in pattern suggests that socialization agents, namely, parents and teachers, are now evaluating patterns of emotion and emotion regulation in a more westernized manner and are responding accordingly.

Cultural norms and ideals also shape how we come to assess maternal sensitivity. As noted above, noncontingent, dismissing, and overly intrusive behaviors are linked to maladaptive socioemotional profiles, marked by increased negative affect and poor self-regulation skills (Kiel & Kalomiris, 2015). Cross-cultural work suggests that infant outcomes are not necessarily tied to specific emotional profiles and maternal behaviors. Rather, maternal sensitivity is evident in the match to cultural expectations (Friedlmeier & Trommsdorff, 1999). For example, in Germany, mothers focus on the cause of an emotion when helping the child regulate and meet the culturally approved target response. Mothers who scaffold independent and instrumental responses were deemed more sensitive. In contrast, Japanese mothers often targeted the child's emotional display in response to an affective elicitor. Here, sensitivity was embedded in the ability to mold emotion expressions that supported harmony within the social group. Thus, sensitive Japanese mothers focused on shaping and mirroring facial expressions.

There has been relatively less focus on culture as a context for temperamental variation relative to the parent-focused literature. Many cross-cultural studies rely on country of origin as the proxy for culture (McClelland et al., 2015). The few studies available examine cultural variation via variation in parenting practices. As such, we have a limited view of the mechanisms, beyond parenting, by which culture impacts emotional development. Indeed, another limitation is that once culture is introduced to a study, many of the other levels of analysis are not included as well. Thus, we have few studies examining psychophysiological indices of temperament and emotion as a function of variation in cultural socialization practices (Hampton & Varnum, 2018; Soto, Lee, & Roberts, 2016). It is also difficult to bootstrap from other research traditions focused on cross-cultural considerations. For example, while personality psychology has traditionally focused on identifying "modal" personality traits (Chen & Schmidt, 2015), much of the developmental work has focused on individual differences.

Cultural considerations can also complicate how researchers go about comparing developmental processes across context. Take, for example, parental reports of emotion and temperament. Sociocultural considerations will alter the display and meaning of temperament traits (Chen & Schmidt, 2015). Expectations for a child's behavior may lead to nuanced shifts in ratings, changing the concordance between parental report of temperament and observed behavior in the laboratory (McClelland et al., 2015). Endorsing that your child is shy and reserved has a different meaning for a parent in rural China versus urban Los Angeles. Thus, the ratings must be coupled with adaptive and functional profiles to see if surface similarities in temperament-links emotion displays have the same developmental meanings (Chen et al., 1995; De Los Reyes & Kazdin, 2005).

Beyond the basic emotions, we can also see that some emotion categories are constrained at the level of definition by the culture (McClelland et al., 2015). For example, shame is a culturally embedded emotion tied to the norms of the culture or the group. In a similar vein, disgust is a socially meditated emotion building on low-level sensory processes. Temperamental variation in sensitivity to external assessments, and sensitivity to sensory input, may set the

foundations on which shame and disgust emerge (Aron et al., 2010).

Cultural forces will shape the socialization behavior and targets that caregivers use to shape and judge child behavior. However, if we tilt the view, then we can see that patterns of individual traits, both inherent and emergent, will then color the general tenor of the culture. A culture that pulls for reserved behavior may then be reinforced by individuals whose reserved traits are valued—these are the individuals that take on social leadership positions and model the cultural ideal. We see a systematic and successive alteration in the dynamic relation between the individual and the environment as children and their caregivers engage in the co-construction of both individual development and culture (Mistry & Dutta, 2015; Overton & Molenaar, 2015).

Regulation Across Context

Patterns of over- and under-regulation are often associated with variation in temperament traits. However, it is not always apparent where researchers should mark the border between adaptive regulation, under-regulation, and over-regulation. Overregulation may be particularly vexing since decreases in emotion have traditionally been used as the axiomatic marker of adaptive regulation. One potential signpost comes from noting functional outcomes of regulatory strategies across contexts. That is, the child perseverates in specific emotional behavioral and emotion regulation strategies across contexts even when they are not associated with goal attainment or competing "positive" alternatives relevant to that *place* in that *moment* (Martins, Soares, Martins, Tereno, & Osório, 2012).

Often the characterization of over- and under-regulation is not linear. For example, Cole (Cole, Dennis, Smith-Simon, & Cohen, 2009) presented children with an appetitive toy in a locked box, accompanied by the wrong key. The child who almost immediately gives up in anger, frustration, or disappointment is considered a classic marker of poor emotional regulation associated with impulsivity and poor inhibitory control. However, at the other end of the spectrum, we could question the adaptiveness of the child who continues to work on the problem—even to the point of obsession—long past the point when most children rightly classify this as an impossible task. Overregulation can restrict the range of the child's emotional experience and is associated with a lack of openness to alternate strategies that can create emotional and behavioral flexibility (Pérez-Edgar, 2018). Overregulation also tends to rely on behaviors embedded in the self (self-soothing) at the expense of socially mediated regulatory strategies (Martins et al., 2012).

Regulation is not a state of neutral homeostatic mechanism. That is, increases in arousal are more likely to be maintained, and for longer, than equivalent decreases in arousal (Wass et al., 2018). Indeed, you can see "metastatic" processes in which the initial trigger grows larger over time and becomes self-sustaining. In this way, an emotional state, and the accompanying regulatory response, leaves an imprint long after the child has left the context triggering the acute emotional incident. The dual-systems model, for example, suggests that regulatory functions may be used by temperamentally at-risk children to reinforce and sustain early reactive tendencies, rather than modulate initial responses back to baseline (Henderson & Wilson, 2017).

The Child as a Context

As a final, more speculative, discussion of context, there is the endoenvironment. The endoenvironment approaches the child as the context of development in which markers of risk and resilience may behave in a unique manner (Chen & Schmidt, 2015). For example, the error-related negativity (ERN) is an event-related potential (ERP) generated following an incorrect behavioral response (McDermott et al., 2009). The ERN is thought to reflect either the general process of cognitive control and performance monitoring (Moser, 2017) or pattern of fear sensitivity (Meyer, 2017). Traditionally, the ERN was examined with children at risk for ADHD or

externalizing concerns (Banaschewski et al., 2003), and the consensus was that larger ERNs was associated with more adaptive outcomes. Thus, the ERN is typically seen as a resilience factor.

However, among temperamentally anxious or fearful children, the ERN has a less rosy predictive profile. Instead, high levels of anxiety or temperamental fearfulness, when coupled with a large ERN, are associated with more emotional reactivity and poorer adaptive functioning (Brooker & Buss, 2014b; Lahat et al., 2014; McDermott et al., 2009). This pattern is particularly acute when embedded in the larger context of harsh parenting (Brooker & Buss, 2014a). In this circumstance, cognitive control mechanisms may be called on to canalize and potentiate risk, in line with the dual-systems model (Henderson & Wilson, 2017).

In the same way, temperament shapes the child's understanding and representation of the social environment. For example, over development, theory of mind allows children to extract and understand the thoughts and intentions of others (Wellman, Cross, & Watson, 2001). A child's interpretation of another's goals and motivations are, in turn, colored by their own temperament traits. For children wary of social interactions, the interpretation may have negative overtones. As such, in the case of temperamental fearfulness, increases in theory of mind are actually associated with less social competence (Bowman & Fox, 2018).

Holodynski and Friedlmeier (2006) argue that development is the *desomatization* of emotion as the child builds a repertoire of emotion signs that are used as a means of communication, in addition to experiencing emotions as an internalized phenomenological state. This process of course involves the person, in context, taking on new skills and traits over time. The child, as a context, is particularly important to capturing emotional processes. Indeed, if the child is removed, how do you measure a construct which is built from multiple subcomponents, parts of which are inherently subjective? Unlike other behaviors, we cannot simply dismiss subjective report out of hand: "Actually, you did not feel angry—we were unable to detect a significant increase in heart rate in conjunction with corrugator muscle contraction." While researchers can assess emotion across many levels of analysis, the subjective view is uniquely the one source of information that cannot be easily set aside or dismissed out of hand.

Time

Developmental psychology is focused on characterizing, and hopefully explaining, change across time. In addition to carefully choosing the construct and population of interest, researchers also assess the time scale of their observations. That is, for any one question, there are likely both macro and micro levels of change. We see change in both the moment, within a specific window of behavior, cognition, or feeling, and across development, typically bound to markers of maturation or age. Thus, there is a tension between focusing on the rapid succession of functions, a microlevel approach (Cole & Hollenstein, 2018), and setting aside some fine-grain data in order to marshal resources to examine larger arcs of development at the macro-level (Caspi et al., 2003).

In designing studies, researchers must also race the constructs' known rate of change. That is, to capture change in a construct, we need to test at a pace faster than the rates of developmental change (Brownell et al., 2015). For example, if we are interested in infants' ability to carry out the classic A-not-B task, it would be fruitless to test at 6, 12, and 18 months of age with the same form of the task since the participants would be at floor at 6 months, likely at ceiling by 12 months, and almost certainly by 18 months. The researcher would have missed the rapid onboarding of skill that occurs in the second half of the first year of life (MacNeill, Ram, Bell, Fox, & Pérez-Edgar, 2018). In general, more complex traits tend to emerge and evolve at a more gradual pace. For example, examining emotion-coping strategies in adolescence can often capture meaningful change on a yearly basis (Compas, Connor-Smith, & Jaser, 2004; Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001). Across

development, we see temperament-linked variation in emotion at both the micro- and macro-levels of analysis.

Micro-level Changes

In coupling temperament to emotion, researchers typically move beyond documenting the presence of an emotion and additionally observe the intensity, duration, and frequency of an emotion. That is, temperament research couples valence with volatility (Morales et al., 2018), making variation over time central to the work. As noted above, researchers examine multiple components of interest when characterizing the child's response to his or her environment. First, beyond a discrete emotion, they are typically interested in the behavioral (approach/withdrawal) and cognitive (interpretation of threat or reward) response. Second, there is the trigger to this response. For some children, the triggers may be rather narrow and infrequently encountered. For other children, they are amorphous and may be lurking around many a corner.

Third, there is the intensity of the response. Here, the assumption is that the pitch and extent of the response reflects the child's temperamental reactivity. Highly reactive children should show intense emotions. Of course, this assumption is often difficult to capture beyond infancy as regulatory mechanisms can quickly come into play (Cole et al., 2018; Perry & Calkins, 2018; Rothbart, Ziaie, & O'Boyle, 1992). Fourth, there is the speed of the response. For some children, the affective and behavioral response is slow building, needing multiple triggers or sustained exposure to draw out a response. For others, the first exposure, even if fleeting, is enough to cause the child to embrace or pull away. In both cases, however, biological markers may outpace outward behavioral signs, particularly in older children.

Finally, there is the question of malleability. Again, this pulls in the question of regulation, carried by either the external environment or the self. The argument is that temperament-linked responses are easily triggered, quick to emerge, and highly pitched and would be difficult to modulate. Thus, high levels of reactivity may set the stage for a relatively unmalleable socioemotional behavior. Microscopic changes in emotion amplification and attenuation lead to macroscopic changes, as the system moves from one orderly state to another (Cole & Hollenstein, 2018). Thus, the accumulations of small slice of emotional experience will "stack" together to build stable socioemotional profiles evident over larger time scales, and across contexts.

Macro-level Changes

Although a central component of most temperament theories is that emotional and behavioral profiles should be relatively stable across time and space, practical considerations often limit the extent to which researchers can directly observe and follow the ebbs and flows of temperament over long time frames. First, the phenotypic expression of temperament will change over time. Practically, this reflects emotion regulation strategies that are brought to bear, first by parents, and then the child themselves, to modulate emotions to match individual goals and cultural expectations. The aspects of daily life that are salient to the child, and thus worthy of an affective response, also change. This is a core developmental precept. Unfortunately, this developmental imperative often runs head first into traditional analytical barriers. That is, many analytic approaches are built on the presumption (if not insistence) that items of measurement or stimuli triggering responses must be invariant over time (Khoo, West, Wu, & Kwok, 2006). If not, you are not "truly" examining a repeated measure. However, one could not expect that a stranger dressed as a clown would elicit the same response from an individual at age 2, 12, and 22. Thus, it is up to the researcher to carefully define the latent construct of interest and then operationally define an age-appropriate probe for that construct. Thus, if we believe that temperament is fairly stable over time and we are examining rank order stability, then the phenotypic expression of emotion must change in order to adaptively meet the

evolving challenges of daily functioning (Fox et al., 2001).

When comparing rank order stability versus mean level continuity, it is also important to note that the universe of measures and ratings will also change over time (Brownell et al., 2015). That is, change in rank order may reflect a shuffling of individuals within a fairly stable distribution of traits. However, change in rank order may also reflect the expansion or contraction of a measure which then changes the relation within the population. For example, consider two items from the Child Behavior Questionnaire (CBQ, Putnam & Rothbart, 2006): "Has temper tantrums when s/he doesn't get what s/he wants" and "Cries sadly when a favorite toy gets lost or broken." A parent of a 4-year-old endorsing this item would elicit different interpretations from researchers than if the parent of a 14-year-old endorsed the item. At age 4, you may expect a broader distribution of endorsements and more "space" in which to order and slot children. At age 14, however, you may expect a large swath of children to be at floor, such that a relatively small shift in behavior would produce a large shift in order. This is why the CBQ is targeted for 3- to 7-year-olds, and these questions do not appear in the age-appropriate measure, the EATQ (Ellis & Rothbart, 2001). As such, a measure must have sufficient variability at each time point of interest in order to extract a true signal of stability or change. In addition, the most influential processes shaping emotional function may vary along a developmental pathway, such that you will see changes in the relative strength of explanatory processes (Cummings & Valentino, 2015).

Another important consideration is the need to carefully select the construct believed to drive change over time. As discussed earlier, Bowman and Fox (2018) argue that emotion is not central to temperament. Rather, questions of motivation may be more important. Thus, the core measure of temperament over time may not be in emotion displays but rather in the motivational forces that shape a child's response to the environment. For example, the teenager who declines to attend the school dance may be presenting with the same withdrawal tendencies as the preschooler who sits quietly in the corner and observes other children in play (Henderson et al., 2018). Research in line with Goldsmith and Campos (1982, 1986) in contrast may systematically manipulate the environment in order to elicit their central marker of interest, such a clear behavioral fear response.

If there is a recipe for temperament-linked emotional trajectories, the current chapter has touched on three ingredients so far. That is, emotional development is fueled by the child, embedded in specific contexts, displaying variations in emotion reactivity and regulation, as well as motivated behavior, over time. Implicit in the text has been the common catalyst that can point development toward one of the many potential trajectories—namely, experience.

Experience

One historical critique of the temperament literature has centered on the implication that the child's developmental trajectory is biologically driven, largely predetermined, and impervious to sociocultural forces. However, data emerging over the last three decades suggests quite the opposite. That is, temperamentally reactive infants and children are acutely sensitive to inputs from the environment (Ellis et al., 2011; Kiff et al., 2011; Lengua & Kovacs, 2005). As with time, there are both micro- and macro-level experiences that shape temperament development. For the micro, researchers can examine the acute experience that triggers a specific emotional state or motivated response. For the macro, researchers can focus on the patterns of individual and interpersonal events that shape the child's view of the self and the environment.

In the Plasticity for Affective Neurocircuitry model (Fox, Hane, & Pine, 2007), for example, early temperament shapes functioning over time and is modified by experience as caregiver behavior exposes children to varying levels of threat. As noted earlier, both the diathesis stress and differential susceptibility models suggest that temperamental variation increases the variability (multifinality) of early life experiences on devel-

opmental outcomes. It is the foundation for "adaptive phenotypic plasticity" (Ellis & Boyce, 2008).

Rather than minimizing the role of the environment, temperament research highlights how experience shapes fundamental individual traits. First, animal models and human emotion research has expanded our understanding of the bidirectional and interwoven relationship between individual traits and the environment. Indeed, this bidirectionality has expanded to even incorporate the level of genetics such that experience in the context of individual traits will modify the immediate and long-term pattern of gene expression (Diorio & Meaney, 2007; Francis, Diorio, Liu, & Meaney, 1999). Epigenetics reflect alterations in methylation and histone modification that are in response to environmental conditions but do not change the underlying DNA sequence (Edelman et al., 2012). As a result, the lived experiences of the child can amplify or mute gene expression.

The most extensive work has relied on animal models. For example, in rat models, lower levels of nurturing behavior in dams, such as licking and grooming, are associated with fewer glucocorticoid receptors in their pups (Cavigelli et al., 2007). As a result, these offspring will show increased sensitivity to stress (Hane & Fox, 2006, 2016). For an organism or child more open to environmental input, perhaps carried by variation at the epigenetic level, environmental experience may alter the developmental unspooling of initial temperamental traits. To start, this environmental input may be predominantly carried by parents. However, this process will broaden to incorporate other adults (e.g., teachers) and peers. It will broaden again as the child moves farther out from the familial unit and begins to experience (and often choose) varied environments (Pérez-Edgar, 2018).

At the micro level, the research illustrates how the interaction of temperament and experience can shape different trajectories and lead to observed emotional profiles. For example, BI is characterized by a withdrawal response to novelty in the environment. Exuberance, in contrast, is marked by a positive response to novelty. In the face of goal blockage, a common laboratory manipulation (Buss & Goldsmith, 2000), the differences in a child's response can be striking. A BI child may withdraw, appearing deflated and defeated. The exuberant child, in contrast, may show frustration (Dollar & Stifter, 2012; Stifter, Putnam, & Jahromi, 2008). When the response to a goal and its blocking becomes more diffuse, frustration may turn to low-level patterns of irritability for the child. Irritability, over time, may fuel poor self-regulation, particularly in nonsupportive environments that cannot help scaffold the child's regulatory response. The combination of reward sensitivity, goal blockage, and poor self-regulation may lead to an explosive negative response. In this way, the frequently observed temper tantrum can be conceptualized as an emergent property of the child responding to his daily experience (Roy et al., 2013).

If the environment is supportive, the child can learn to automate some adaptive behavioral and cognitive patterns. As such, the child can free up a great deal of cognitive resources that require active and effortful self-regulation (McClelland et al., 2015). Repeated or sustained negative experiences, in contrast, can increase levels of toxic stress, which, in turn can degrade the child's ability to automate self-regulation. However, it is important to note that self-regulation is and of itself is not static. Rather, adaptive and flexible traits can help the child take on (or leave behind) regulatory processes that do not match the challenges and goals at hand.

At a broader level, we can also see that temperament influences at higher order levels of functioning. Indeed, we can approach personality as the combination of temperament with life history (Anaya & Pérez-Edgar, 2019; Buss, Pérez-Edgar, Vallorani, & Anaya, 2019; Kagan, 2018a). The social interactions that work to shape the developmental progression of temperament to personality are interwoven with layers of individual expectation and cultural norms (Chen & Schmidt, 2015). Temperament can vary the individual's motivation of engage win these interactions and trigger variation in the environment's response depending on the extent to which they

reflect expected ideals. As such, the evolution of temperament into personality should be thought of as a developmental process, rather than the maturation of a static trait marker (Buss et al., 2019; Chen & Schmidt, 2015).

Conclusions

Temperament is embodied in *patterns* of emotion (Bates et al., 2008) that are distributed across a spectrum of elicitors (Buss, 2011) and emerge early (Kagan et al., 2007) but take time to stabilize (Fox et al., 2015). Emotion is often the target of parental socialization, attempting to both potentiate and minimize specific functional profiles. As a result, much of the impact of early temperament can be seen in emotional and socioemotional functioning (Root & Stifter, 2010). The form and function of temperament are embedded in our view of social adaptation. That is, the negative consequences of heightened reactivity, coupled with ineffective regulation, are codified in our clinical views of internalizing and externalizing difficulties (Bates et al., 2008) and "goodness-of-fit" matches to sociocultural expectations (Chen & Schmidt, 2015; Chess & Thomas, 2013).

The literature reviewed in the current chapter suggests several open gaps in our knowledge. Five are noted here:

First, it is not clear how to best characterize and interpret individual differences across multiple levels of analysis evident *within* a person and *across* individuals. Lamb (2015) points out that we have expanded our ability to explain patterns and variations in development while undermining the purity of discrete theoretical approaches. While evident that individual differences may have contributed to these blurred lines, the field could benefit from construct-level definitions that have greater specificity with respect to the source, context, and timing of the measure (Kagan, 2016).

Second, there is a need to better integrate advanced methods and analytics with more nuanced measures of the environment. Overton and Molenaar (2015) argue that we need complex systems to capture the "relative plasticity" of individuals across persons, space, and time. The question of "relative" is then shaped by both individual traits and the individual's interactions with the environment (McClelland et al., 2015). Environments that work to modulate a child's initial trait will of course provide data that supports greater plasticity. In contrast, a child with little pressure to change in order to adapt to environmental expectations may provide little evidence for plasticity.

Third, the field tends to define a construct based on outcome, as opposed to process. For example, is a negative response to a spider necessarily a temperamental response? A bad prior encounter with a spider may be the catalyst for fear learning, and, at the extreme, a phobia. This phobic response is not equivalent to fear responses that can be tied to sensitivity to novelty or perceived threat. Underlying both mechanisms is a near-universal perceptual response which may reflect a conserved bias to attend to spider-like stimuli (LoBue, Rakison, & DeLoache, 2010). We know that "developmental systems allow for more than one way to reach a socially important outcome" (Bates et al., 2008). Thus, we must focus on factors that translate a tendency into actual behavior for an individual child.

Fourth, we need to independently measure both emotion and the proposed regulation strategy (Cole et al., 2004). If not, researchers fall into the trap of a circular confound. There is an inherent need for microlevel measures to capture temporal ordering. Traditionally, researcher look to see if a strategy is associated with a change in emotion, taking an observation that they follow each other close in time as evidence for regulation (Ekas, Braungart-Rieker, & Messinger, 2018). However, until recently, the field did not have the methods to see if the strategy *led* to the change in emotion (Cole & Hollenstein, 2018). Thus, there is the danger that we have inadvertently been alternating our dependent and independent variables based on the idiosyncrasies of any one study (Brownell et al., 2015).

Fifth, although there are some cross-cultural studies available, there is a dearth of non-WEIRD (western, educated, industrialized, rich, and

democratic) research (Henrich, Heine, & Norenzayan, 2010). Much of the published work in temperament focuses on US and western European middle-class families. Indeed, "there are virtually no studies of BI/SW [behaviorally inhibited/socially withdrawn] young children who are growing up in stressful, dangerous community and family settings" (p. 9; Chronis-Tuscano, Danko, Rubin, Coplan, & Novick, 2018). These gaps limit our understanding of culturally linked socialization practices and the unfolding of temperament across diverse contexts and experiences. When the field does engage with diversity, in the form of culture, the vast majority of the work has compared WEIRD populations to Asian populations, particularly in Japan and China, framing the comparison between collectivist vs. individualistic cultures (Chen, 2010).

The current chapter suggests that a core contribution of the temperament literature is its focus on the individual child interacting with his or her specific environment(s) over time. Variations across individuals within a context build to variations across individuals across time. The emergent properties of development suggest that relationships within and across individuals will not necessarily remain stable across time, modulating the rate and slope of change. In the end, the person-centered approach at the heart of temperament research brings together variables of interest to help reconstruct the child embedded in the data.

References

Aktar, E., Bockstaele, B. V., Pérez-Edgar, K., Wiers, R. W., & Bögels, S. M. (2018). Intergenerational transmission of attentional bias and anxiety. *Developmental Science*, e12772.

Aktar, E., & Bögels, S. M. (2017). Exposure to parents' negative emotions as a developmental pathway to the family aggregation of depression and anxiety in the first year of life. *Clinical Child and Family Psychology Review, 20*(4), 369–390.

Almas, A. N., Phillips, D. A., Henderson, H. A., Hane, A. A., Degnan, K. A., Moas, O. L., & Fox, N. A. (2011). The relations between infant negative reactivity, non-maternal childcare, and children's interactions with familiar and unfamiliar peers. *Social Development, 20*, 718–740. https://doi.org/10.1111/j.1467-9507.2011.00605.x

Als, H., Tronick, E., & Brazelton, T. B. (1979). Analysis of face-to-face interaction in infant-adult dyads. In *Social interaction analysis: Methodological issues* (pp. 33–76). Madison, WI: University of Wisconsin Press.

Anaya, B., & Pérez-Edgar, K. (2019). Personality development in the context of temperament and parenting dynamics. *New Ideas in Psychology* 53, 37–46.

Aron, A., Ketay, S., Hedden, T., Aron, E. N., Rose Markus, H., & Gabrieli, J. D. (2010). Temperament trait of sensory processing sensitivity moderates cultural differences in neural response. *Social Cognitive and Affective Neuroscience, 5*(2–3), 219–226.

Banaschewski, T., Brandeis, D., Heinrich, H., Albrecht, B., Brunner, E., & Rothenberger, A. (2003). Association of ADHD and conduct disorder – Brain electrical evidence for the existence of a distant subtype. *Journal of Child Psychology and Psychiatry, 44*, 356–376.

Bandura, A. (1978). Social learning theory of aggression. *Journal of Communication, 28*(3), 12–29.

Bates, J. E., Goodnight, J. A., & Fite, J. E. (2008). Temperament and emotion. *Handbook of Emotions, 3*, 485–496.

Belsky, J., Bakermans-Kranenburg, M. J., & van IJzendoorn, M. H. (2007). For better and for worse: Differential susceptibility to environmental influences. *Current Directions in Psychological Science, 16*, 300–304.

Berger, A., Tzur, G., & Posner, M. I. (2006). Infant brains detect arithmetic errors. *Proceedings of the National Academy of Sciences, 103*(33), 12649–12653.

Blackford, J. U., Clauss, J. A., & Benningfield, M. M. (2018). The neurobiology of behavioral inhibition as a developmental mechanism. In *Behavioral inhibition* (pp. 113–134). Cham, Switzerland: Springer.

Bowman, L. C., & Fox, N. A. (2018). Emotion is not a core feature of temperament. In A. S. Fox, R. C. Lapate, A. J. Shackman, & R. J. Davisdon (Eds.), *The nature of emotion: Fundamental questions* (2nd ed., pp. 54–58). New York: Oxford University Press.

Braungart, J. M., & Stifter, C. A. (1991). Regulation of negative reactivity during the strange situation: Temperament and attachment in 12-month-old infants. *Infant Behavior and Development, 14*(3), 349–364.

Bronfenbrenner, U., & Morris, P. A. (1998). The ecology of developmental processes. In W. Damon & R. M. Lerner (Eds.), *Handbook of child psychology: Theoretical models of human development* (pp. 993–1028). Hoboken, NJ: Wiley.

Brooker, R. J., & Buss, K. A. (2014a). Harsh parenting and fearfulness in toddlerhood interact to predict amplitudes of preschool error-related negativity. *Developmental Cognitive Neuroscience, 9*, 148–159.

Brooker, R. J., & Buss, K. A. (2014b). Toddler fearfulness is linked to individual differences in error-related negativity during preschool. *Developmental Neuropsychology, 39*(1), 1–8.

Brownell, C. A., Lemerise, E. A., Pelphrey, K. A., & Roisman, G. I. (2015). Measuring socioemotional development. In *Handbook of child psychology and developmental science* (pp. 1–46). Hoboken, NJ: Wiley.

Buss, A. H., & Plomin, R. (1975). *A temperament theory of personality development*. New York: Wiley-Interscience.

Buss, A. H., & Plomin, R. (1986). The EAS approach to temperament. In R. Plomin & J. Dunn (Eds.), *The study of temperament: Changes, continuities and challenges* (pp. 67–79). Hillsdale, NJ: Lawrence Erlbaum.

Buss, K. A. (2011). Which fearful toddlers should we worry about? Context, fear regulation, and anxiety risk. *Developmental Psychology, 47*, 804–819.

Buss, K. A., Davis, E. L., Kiel, E. J., Brooker, R. J., Beekman, C., & Early, M. C. (2013). Dysregulated fear predicts social wariness and social anxiety symptoms during kindergarten. *Journal of Child Clinical & Adolescent Psychology, 42*(5), 603–616. https://doi.org/10.1080/15374416.2013.769170

Buss, K. A., & Goldsmith, H. H. (1998). Fear and anger regulation in infancy: Effects on the temporal dynamics of affective expression. *Child Development, 69*, 359–374.

Buss, K. A., & Goldsmith, H. H. (2000). *Manual and normative data for the Laboratory Temperament Assessment Battery – Toddler Version*. Retrieved from https://emotiondev.la.psu.edu/

Buss, K. A., & Kiel, E. J. (2013). Temperamental risk factors for pediatric anxiety disorders. In R. A. Vasa & A. K. Roy (Eds.), *Pediatric anxiety disorders: A clinical guide* (pp. 47–68). New York: Springer.

Buss, K. A., Pérez-Edgar, K., Vallorani, A., & Anaya, B. (2019). Emotion reactivity and regulation: A developmental model of links between temperament and personality. In R. Shiner, J. Tackett, & D. McAdams (Eds.), *Handbook of personality development* (pp. 106–117). New York: Guilford Press.

Calkins, S. D., & Fox, N. A. (2002). Self-regulatory processes in early personality development: A multilevel approach to the study of childhood social withdrawal and aggression. *Development and Psychopathology, 14*, 477–498.

Campos, J. J., Frankel, C. B., & Camras, L. (2004). On the nature of emotion regulation. *Child Development, 75*(2), 377–394.

Capitanio, J. P. (2018). Behavioral inhibition in nonhuman primates: The elephant in the room. In *Behavioral inhibition* (pp. 17–33). Cham, Switzerland: Springer.

Caspi, A. (1998). Personality development across the life course. In N. Eisenberg (Ed.), *Handbook of child psychology* (Social, emotional, and personality development) (Vol. 3, pp. 311–388). New York: Wiley.

Caspi, A., Harrington, H., Milne, B., Amell, J. W., Theodore, R. F., & Moffitt, T. E. (2003). Children's behavioral styles at age 3 are linked to their adult personality traits at age 26. *Journal of Personality and Social Psychology, 71*, 495–513.

Cavigelli, S. A. (2018). Behavioral inhibition in rodents: A model to study causes and health consequences of temperament. In *Behavioral inhibition* (pp. 35–58). Cham, Switzerland: Springer.

Cavigelli, S. A., Stine, M. M., Kovacsics, C., Jefferson, A., Diep, M. N., & Barrett, C. E. (2007). Behavioral inhibition and glucocorticoid dynamics in a rodent model. *Physiology & Behavior, 92*, 897–905.

Chen, X. (2010). Shyness-inhibition in childhood and adolescence. In *The development of shyness and social withdrawal* (pp. 213–235). New York: Guilford Press.

Chen, X., Rubin, K. H., Li, B.-s., & Li, D. (1999). Adolescent outcomes of social functioning in Chinese children. *International Journal of Behavioral Development, 23*(1), 199–223.

Chen, X., Rubin, K. H., & Li, Z.-y. (1995). Social functioning and adjustment in Chinese children: A longitudinal study. *Developmental Psychology, 31*(4), 531.

Chen, X., & Schmidt, L. A. (2015). Temperament and personality. In *Handbook of child p.sychology and developmental science* (pp. 1–49). Hoboken, NJ: Wiley.

Chess, S., & Thomas, A. (2013). *Goodness of fit: Clinical applications, from infancy through adult life*. London, UK: Routledge.

Chronis-Tuscano, A., Danko, C. M., Rubin, K. H., Coplan, R. J., & Novick, D. R. (2018). Future directions for research on early intervention for young children at risk for social anxiety. *Journal of Clinical Child and Adolescent Psychology, 47*, 655–667.

Chorpita, B. F., & Barlow, D. H. (1998). The development of anxiety: The role of control in the early environment. *Psychological Bulletin, 124*(1), 3–21.

Clauss, J. A., & Blackford, J. U. (2012). Behavioral inhibition and risk for developing social anxiety disorder: A meta-analytic study. *Journal of the American Academy of Child and Adolescent Psychiatry, 51*, 1066–1075. https://doi.org/10.1016/j.jaac.2012.08.002

Cohn, J. F., & Tronick, E. Z. (1987). Mother–infant face-to-face interaction: The sequence of dyadic states at 3, 6, and 9 months. *Developmental Psychology, 23*(1), 68.

Cole, P. M., Bendezú, J. J., Ram, N., & Chow, S.-M. (2017). Dynamical systems modeling of early childhood self-regulation. *Emotion, 17*(4), 684.

Cole, P. M., Dennis, T. A., Smith-Simon, K. E., & Cohen, L. H. (2009). Preschoolers' emotion regulation strategy understanding: Relations with emotion socialization and child self-regulation. *Social Development, 18*(2), 324–352.

Cole, P. M., & Hollenstein, T. (2018). *Emotion regulation: A matter of time*. New York: Routledge.

Cole, P. M., Lougheed, J. P., & Ram, N. (2018). The development of emotion regulation in early childhood: A matter of multiple time scales. In *Emotion regulation* (pp. 70–87). New York: Routledge.

Cole, P. M., Martin, S. E., & Dennis, T. A. (2004). Emotion regulation as a scientific construct: Methodological challenges and directions for child development research. *Child Development, 75*, 317–333.

Compas, B. E., Connor-Smith, J., & Jaser, S. S. (2004). Temperament, stress reactivity, and coping: implications for depression in childhood and adolescence. *Journal of Clinical Child and Adolescent Psychology, 33*(1), 21–31.

Compas, B. E., Connor-Smith, J. K., Saltzman, H., Thomsen, A. H., & Wadsworth, M. E. (2001). Coping with stress during childhood and adolescence: Progress, problems, and potential in theory and research. *Psychological Bulletin, 114*, 323–344.

Cummings, E. M., & Valentino, K. (2015). Developmental psychopathology. In *Handbook of child psychology and developmental science* (pp. 1–41). Hoboken, NJ: Wiley.

Davies, P. T., & Cicchetti, D. (2004). Toward an integration of family systems and developmental psychopathology approaches. *Development and Psychopathology, 16*(3), 477–481.

Davis, E. L., Levine, L. J., Lench, H. C., & Quas, J. A. (2010). Metacognitive emotion regulation: Children's awareness that changing thoughts and goals can alleviate negative emotions. *Emotion, 10*(4), 498.

De Los Reyes, A., & Kazdin, A. E. (2005). Informant discrepancies in the assessment of childhood psychopathology: A critical review, theoretical framework, and recommendations for further study. *Psychological Bulletin, 131*, 483.

Degnan, K. A. (2017). Temperament. In B. Hopkins, E. Geangu, & S. Linkenauger (Eds.), *The Cambridge encyclopedia of child development*. Cambridge: Cambridge University Press.

Degnan, K. A., Almas, A. N., & Fox, N. A. (2010). Temperament and the environment in the etiology of childhood anxiety. *Journal of Child Psychology and Psychiatry, 51*, 497–517. https://doi.org/10.1111/j.1469-7610.2010.02228.x

Degnan, K. A., Hane, A. A., Henderson, H. A., Moas, O. L., Reeb-Sutherland, B. C., & Fox, N. A. (2011). Longitudinal stability of temperamental exuberance and social-emotional outcomes in early childhood. *Developmental Psychology, 47*, 765–780.

Denham, S. A., Bassett, H. H., & Wyatt, T. (2007). The socialization of emotional competence. In *Handbook of socialization: Theory and research* (pp. 614–637). New York: Guilford Press.

Dennis, T. (2006). Emotional self-regulation in preschoolers: The interplay of child approach reactivity, parenting, and control capacities. *Developmental Psychology, 42*(1), 84.

Derryberry, D., & Rothbart, M. K. (2002). Temperament in children. In *Psychology at the turn of the millennium* (Vol. 2, pp. 33–52). East Sussex, UK: Psychology Press.

Dickson, W. K.-L., & Dickson, A. (2000). *History of the kinetograph, kinetoscope and kinetophonograph*. New York: The Museum of Modern Art.

Diorio, J., & Meaney, M. J. (2007). Maternal programming of defensive responses through sustained effects on gene expression. *Journal of Psychiatry & Neuroscience, 32*, 275–284.

Dollar, J. M., & Stifter, C. A. (2012). Temperamental surgency and emotion regulation as predictors of childhood social competence. *Journal of Experimental Child Psychology, 112*(2), 178–194.

Edelman, S., Shalev, I., Uzefovsky, F., Israel, S., Knafo, A., Kremer, I., … Ebstein, R. P. (2012). Epigenetic and genetic factors predict women's salivary cortisol following a threat to the social self. *PLoS One, 7*(11), e48597.

Edwards, S. L., Rapee, R. M., & Kennedy, S. (2010). Prediction of anxiety symptoms in preschool-aged children: examination of maternal and paternal perspectives. *Journal of Child Psychology and Psychiatry, 51*(3), 313–321.

Eisenberg, N., Spinrad, T. L., & Eggum, N. D. (2010). Emotion-related self-regulation and its relation to children's maladjustment. *Annual Review of Clinical Psychology, 6*, 495–525.

Eisenberg, N., Zhou, Q., Spinrad, T. L., Valiente, C., Fabes, R. A., & Liew, J. (2005). Relations among positive parenting, children's effortful control, and externalizing problems: A three-wave longitudinal study. *Child Development, 76*(5), 1055–1071.

Ekas, N. V., Braungart-Rieker, J. M., & Messinger, D. S. (2018). The development of infant emotion regulation: Time is of the essence. In *Emotion regulation* (pp. 49–69). New York: Routledge.

Ellis, B. J., & Boyce, W. T. (2008). Biological sensitivity to context. *Current Directions in Psychological Science, 17*(3), 183–187.

Ellis, B. J., Boyce, W. T., Belsky, J., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2011). Differential susceptibility to the environment: An evolutionary–neurodevelopmental theory. *Development and Psychopathology, 23*(1), 7–28.

Ellis, L. K., & Rothbart, M. K. (2001). *Revision of the early adolescent temperament questionnaire*. Paper presented at the Biennial Meeting of the Society for Research in Child Development, Minneapolis, MN.

Feldman, R., Greenbaum, C. W., & Yirmiya, N. (1999). Mother–infant affect synchrony as an antecedent of the emergence of self-control. *Developmental Psychology, 35*(1), 223.

Feldman, R., Greenbaum, C. W., Yirmiya, N., & Mayes, L. C. (1996). Relations between cyclicity and regulation in mother-infant interaction at 3 and 9 months and cognition at 2 years. *Journal of Applied Developmental Psychology, 17*(3), 347–365.

Feldman, R., Magori-Cohen, R., Galili, G., Singer, M., & Louzoun, Y. (2011). Mother and infant coordinate heart rhythms through episodes of interaction synchrony. *Infant Behavior and Development, 34*(4), 569–577.

Fox, A. S., & Kalin, N. H. (2014). A translational neuroscience approach to understanding the development of social anxiety disorder and its pathophysiology. *American Journal of Psychiatry, 171*(11), 1162–1173.

Fox, N. A., & Calkins, S. D. (1993). Pathways to aggression and social withdrawal: Interactions among temperament, attachment, and regulation. In K. H. Rubin

& J. Asendorpf (Eds.), *Social withdrawal, inhibition and shyness in childhood*. Chicago, IL: University of Chicago Press.

Fox, N. A., Hane, A. A., & Pine, D. S. (2007). Plasticity for affective neurocircuitry: How the environment affects gene expression. *Current Directions in Psychological Science, 16*, 1–5.

Fox, N. A., Henderson, H. A., Marshall, P. J., Nichols, K. E., & Ghera, M. M. (2005). Behavioral inhibition: linking biology and behavior within a developmental framework. *Annual Review of Psychology, 56*, 235–262.

Fox, N. A., Henderson, H. A., Pérez-Edgar, K., & White, L. (2008). The biology of temperament: An integrative approach. In C. Nelson & M. Luciana (Eds.), *The handbook of developmental cognitive neuroscience* (pp. 839–854). Cambridge, MA: MIT Press.

Fox, N. A., Henderson, H. A., Rubin, K. H., Calkins, S. D., & Schmidt, L. A. (2001). Continuity and discontinuity of behavioral inhibition and exuberance: Psychophysiological and behavioral influences across the first four years of life. *Child Development, 72*, 1–21. https://doi.org/10.1111/1467-8624.00262

Fox, N. A., Kirwan, M., & Reeb-Sutherland, B. (2012). Measuring the physiology of emotion and emotion regulation—Timing is everything. *Monographs of the Society for Research in Child Development, 77*, 98–108.

Fox, N. A., Snidman, N., Haas, S. A., Degnan, K. A., & Kagan, J. (2015). The relations between reactivity at 4 months and behavioral inhibition in the second year: Replication across three independent samples. *Infancy, 20*(1), 98–114.

Francis, D., Diorio, J., Liu, D., & Meaney, M. J. (1999). Nongenomic transmission across generations of maternal behavior and stress responses in the rat. *Science, 286*, 1155–1158.

Friedlmeier, W., & Trommsdorff, G. (1999). Emotion regulation in early childhood: A cross-cultural comparison between German and Japanese toddlers. *Journal of Cross-Cultural Psychology, 30*(6), 684–711.

Fu, X., & Pérez-Edgar, K. (2015). Theories of temperament development. In J. D. Wright (Ed.), *The international encyclopedia of social & behavioral sciences* (pp. 191–198). Amsterdam: Elsevier.

García Coll, C., Kagan, J., & Reznick, J. S. (1984). Behavioral inhibition in young children. *Child Development, 55*, 1005–1019. https://doi.org/10.2307/1130152

Geangu, E., Benga, O., Stahl, D., & Striano, T. (2011). Individual differences in infants' emotional resonance to a peer in distress: Self–other awareness and emotion regulation. *Social Development, 20*(3), 450–470.

Goldsmith, H. H. (1996). Studying temperament via construction of the Toddler Behavior Assessment Questionnaire. *Child Development, 67*(1), 218–235.

Goldsmith, H. H., Buss, A. H., Plomin, R., Rothbart, M. K., Thomas, A., Chess, S., … McCall, R. B. (1987). Roundtable: What is temperament? Four approaches. *Child Development, 58*, 505–529.

Goldsmith, H. H., & Campos, J. J. (1982). Toward a theory of infant temperament. In *The development of attachment and affiliative systems* (pp. 161–193). Boston, MA: Springer.

Goldsmith, H. H., & Campos, J. J. (1986). Fundamental issues in the study of early temperament: The Denver Twin Temperament Study. *Advances in Developmental Psychology, 4*, 231–283.

Goldsmith, H. H., & Campos, J. J. (1990). The structure of temperamental fear and pleasure in infants: A psychometric perspective. *Child Development, 61*(6), 1944–1964.

Goldsmith, H. H., & Gagne, J. R. (2012). Behavioral assessment of temperament. In *Handbook of temperament* (pp. 209–228). New York: Guilford Press.

Goldsmith, H. H., & Rothbart, M. K. (1993). *The laboratory temperament assessment battery (LAB-TAB)*. Madison, WI: University of Wisconsin Press.

Greenough, W. T., Black, J. E., & Wallace, C. S. (1987). Experience and brain development. *Child Development, 58*, 539–559.

Hampton, R. S., & Varnum, M. E. (2018). The cultural neuroscience of emotion regulation. *Culture and Brain, 6*(2), 130–150.

Hane, A. A., & Fox, N. A. (2006). Ordinary variations in maternal caregiving influence human infants' stress reactivity. *Psychological Science, 17*, 550–556.

Hane, A. A., & Fox, N. A. (2016). Early caregiving and human biobehavioral development: A comparative physiology approach. *Current Opinion in Behavioral Sciences, 7*, 82–90.

Hastings, P. D., & Rubin, K. H. (1999). Predicting mothers' beliefs about preschool-aged children's social behavior: Evidence for maternal attitudes moderating child effects. *Child Development, 70*(3), 722–741.

Hastings, P. D., Sullivan, C., McShane, K. E., Coplan, R. J., Utendale, W. T., & Vyncke, J. D. (2008). Parental socialization, vagal regulation, and preschoolers' anxious difficulties: Direct mothers and moderated fathers. *Child Development, 79*(1), 45–64.

Henderson, H. A., Green, E. S., & Wick, B. L. (2018). The social world of behaviorally inhibited children: A transactional account. In *Behavioral inhibition* (pp. 135–155). Cham, Switzerland: Springer.

Henderson, H. A., & Wilson, M. J. (2017). Attention processes underlying risk and resilience in behaviorally inhibited children. *Current Behavioral Neuroscience Reports, 2017*, 99–106.

Henrich, J., Heine, S. J., & Norenzayan, A. (2010). Most people are not WEIRD. *Nature, 466*(7302), 29.

Holodynski, M., & Friedlmeier, W. (2006). *Development of emotions and emotion regulation* (Vol. 8). New York: Springer Science & Business Media.

Howarth, G. Z., Guyer, A. E., & Pérez-Edgar, K. (2013). Young children's affective responses to evaluative feedback from peers: A computer-based task sensitive to variation in temperamental shyness and gender. *Social Development, 22*, 146–162.

Jarcho, J. M., & Guyer, A. E. (2018). The neural mechanisms of behavioral inhibition. In *Behavioral inhibition* (pp. 59–90). Cham, Switzerland: Springer.

Kagan, J. (1994). On the nature of emotion. *Monographs of the Society for Research in Child Development, 59*(2–3), 7–24, 250–283.

Kagan, J. (2012). The biography of behavioral inhibition. In M. Zentner & R. L. Shiner (Eds.), *Handbook of temperament* (pp. 69–82). New York: Guilford Press.

Kagan, J. (2016). Follow the evidence, ignore the words. In R. J. Sternberg, S. T. Fiske, & D. J. Foss (Eds.), *Scientists making a difference: One hundred eminent behavioral and brain scientists talk about their most important contributions* (pp. 260–263). New York: Cambridge University Press.

Kagan, J. (2018a). The bases for preservation of emotional biases. In A. S. Fox, R. C. Lapate, A. J. Shackman, & R. J. Davidson (Eds.), *The nature of emotion: Fundamental questions* (2nd ed., pp. 64–67). New York: Oxford University Press.

Kagan, J. (2018b). The history and theory of behavioral inhibition. In *Behavioral inhibition* (pp. 1–15). Cham, Switzerland: Springer.

Kagan, J., Reznick, J. S., Clarke, C., Snidman, N., & García-Coll, C. (1984). Behavioral inhibition to the unfamiliar. *Child Development, 55*(6), 2212–2225.

Kagan, J., Reznick, J. S., & Snidman, N. (1988). Biological bases of childhood shyness. *Science, 240*, 167–171.

Kagan, J., & Snidman, N. (1991). Infant predictors of inhibited and uninhibited profiles. *Psychological Science, 2*, 40–44.

Kagan, J., Snidman, N., Kahn, V., Towsley, S., Steinberg, L., & Fox, N. A. (2007). The preservation of two infant temperaments into adolescence. *Monographs of the Society for Research in Child Development*, i-95.

Khoo, S. T., West, S. G., Wu, W., & Kwok, O. M. (2006). Longitudinal methods. In M. Eid & E. Diener (Eds.), *Handbook of multimethod measurement in psychology* (pp. 301–317). Washington, D.C.: American Psychological Association.

Kiel, E. J., & Buss, K. A. (2011). Prospective relations among fearful temperament, protective parenting, and social withdrawal: The role of maternal accuracy in a moderated mediation framework. *Journal of Abnormal Child Psychology, 39*, 953–966.

Kiel, E. J., & Kalomiris, A. E. (2015). Current themes in understanding children's emotion regulation as developing from within the parent–child relationship. *Current Opinion in Psychology, 3*, 11–16.

Kiff, C. J., Lengua, L. J., & Zalewski, M. (2011). Nature and nurturing: Parenting in the context of child temperament. *Clinical Child and Family Psychology Review, 14*(3), 251.

Kim, B.-R., Stifter, C. A., Philbrook, L. E., & Teti, D. M. (2014). Infant emotion regulation: Relations to bedtime emotional availability, attachment security, and temperament. *Infant Behavior and Development, 37*(4), 480–490.

Kim, S., & Kochanska, G. (2012). Child temperament moderates effects of parent–child mutuality on self-regulation: A relationship-based path for emotionally negative infants. *Child Development, 83*(4), 1275–1289.

Klein, D. N., Dyson, M. W., Kujawa, A., & Kotov, R. (2012). Temperament and internalizing disorders. In M. Zentner & R. L. Shiner (Eds.), *Handbook of temperament*. New York: Guilford.

Lahat, A., Lamm, C., Chronis-Tuscano, A., Pine, D. S., Henderson, H. A., & Fox, N. A. (2014). Early behavioral inhibition and increased error monitoring predict later social phobia symptoms in childhood. *Journal of the American Academy of Child and Adolescent Psychiatry, 53*, 447–455.

Lamb, M. E. (2015). Processes underlying social, emotional, and personality development: A preliminary survey of the terrain. In *Handbook of child psychology and developmental science* (pp. 1–10). Hoboken, NJ: Wiley.

LeDoux, J., & Daw, N. D. (2018). Surviving threats: neural circuit and computational implications of a new taxonomy of defensive behaviour. *Nature Reviews Neuroscience, 19*(5), 269–282.

Lengua, L. J., & Kovacs, E. A. (2005). Bidirectional associations between temperament and parenting and the prediction of adjustment problems in middle childhood. *Journal of Applied Developmental Psychology, 26*(1), 21–38.

LoBue, V., Rakison, D., & DeLoache, J. S. (2010). Threat perception across the lifespan: Evidence for multiple converging pathways. *Current Directions in Psychological Science, 19*, 375–379.

Lunkenheimer, E., Tiberio, S. S., Buss, K. A., Lucas-Thompson, R. G., Boker, S. M., & Timpe, Z. C. (2015). Coregulation of respiratory sinus arrhythmia between parents and preschoolers: Differences by children's externalizing problems. *Developmental Psychobiology, 57*(8), 994–1003.

MacNeill, L., & Pérez-Edgar, K. (in press). Temperament and emotion. In S. Hupp & J. Jewell (Eds.), *The encyclopedia of child and adolescent development*. Wiley Press.

MacNeill, L., Ram, N., Bell, M. A., Fox, N. A., & Pérez-Edgar, K. (2018). Trajectories of infants' biobehavioral development: Timing and rate of A-not-B performance gains and EEG maturation. *Child Development, 89*, 711–724.

Martins, E. C., Soares, I., Martins, C., Tereno, S., & Osório, A. (2012). Can we identify emotion over-regulation in infancy? Associations with avoidant attachment, dyadic emotional interaction and temperament. *Infant and Child Development, 21*(6), 579–595.

McClelland, M. M., Geldhof, G. J., Cameron, C. E., & Wanless, S. B. (2015). Development and self-regulation. In *Handbook of child psychology and developmental science* (pp. 1–43). Hoboken, NJ: Wiley.

McDermott, J. M., Pérez-Edgar, K., Henderson, H. A., Chronis-Tuscano, A., Pine, D. S., & Fox, N. A. (2009). A history of childhood behavioral inhibition and enhanced response monitoring in adolescence are linked to clinical anxiety. *Biological Psychiatry, 65*, 445–448. https://doi.org/10.1016/j.biopsych.2008.10.043

McLeod, B. D., Wood, J. J., & Weisz, J. R. (2007). Examining the association between parenting and childhood anxiety: A meta-analysis. *Clinical Psychology Review, 27*(2), 155–172.

Mesman, J., van IJzendoorn, M. H., & Bakermans-Kranenburg, M. J. (2009). The many faces of the Still-Face Paradigm: A review and meta-analysis. *Developmental Review, 29*(2), 120–162.

Meyer, A. (2017). A biomarker of anxiety in children and adolescents: a review focusing on the error-related negativity (ERN) and anxiety across development. *Developmental Cognitive Neuroscience, 27*, 58–68.

Mistry, J., & Dutta, R. (2015). Human development and culture. In *Handbook of child psychology and developmental science* (pp. 1–38). Hoboken, NJ: Wiley.

Morales, S., Ram, N., Buss, K. A., Cole, P. M., Helm, J. L., & Chow, S. M. (2018). Age-related changes in the dynamics of fear-related regulation in early childhood. *Developmental Science, 21*(5), e12633.

Morales, S., Vallorani, A., & Pérez-Edgar, K. (2019). Young children's behavioral and neural responses to peer feedback relate to internalizing problems. *Developmental Cognitive Neuroscience, 36*, 100610.

Morris, A. S., Robinson, L. R., & Eisenberg, N. (2006). Applying a multimethod perspective to the study of developmental psychology. In M. Eid & E. Diener (Eds.), *Handbook of multimethod measurement in psychology* (pp. 371–384). Washington, D.C.: American Psychological Association.

Moser, J. S. (2017). The nature of the relationship between anxiety and the error-related negativity across development. *Current Behavioral Neuroscience Reports, 4*(4), 309–321.

Mount, K. S., Crockenberg, S. C., Jó, P. S. B., & Wagar, J.-L. (2010). Maternal and child correlates of anxiety in 2½-year-old children. *Infant Behavior and Development, 33*(4), 567–578.

Nachmias, M., Gunnar, M., Mangelsdorf, S., Parritz, R., & Buss, K. (1996). Behavioral inhibition and stressreactivity: The moderating role of attachment security. *Child Development, 67*, 508–522.

Nelson, E. E., Shelton, S. E., & Kalin, N. H. (2003). Individual differences in the responses of naïve rhesus monkeys to snakes. *Emotion, 3*(1), 3–11.

Nigg, J. T., Goldsmith, H. H., & Sachek, J. (2004). Temperament and attention deficit hyperactivity disorder: The development of a multiple pathway model. *Journal of Clinical Child and Adolescent Psychology, 33*, 42–53. https://doi.org/10.1207/S15374424JCCP3301_5

Nozadi, S. S., Troller-Renfree, S., White, L. K., Frenkel, T., Degnan, K. A., Bar-Haim, Y., … Fox, N. A. (2016). The moderating role of attention biases in understanding the link between behavioral inhibition and anxiety. *Journal of Experimental Psychopathology, 7*, 451–465.

Overton, W. F., & Molenaar, P. C. M. (2015). Concepts, theory, and method in developmental science: A view of the issues. In R. M. Lerner (Ed.), *Handbook of child psychology and developmental science* (7th ed.). Hoboken, NJ: Wiley.

Park, S., Belsky, J., Putnam, S., & Crnic, K. (1997). Infant emotionality, parenting, and 3-year inhibition: Exploring stability and lawful discontinuity in a male sample. *Developmental Psychology, 33*(2), 218–227.

Pérez-Edgar, K. (2018). Attention mechanisms in behavioral inhibition: Exploring and exploiting the environment. In *Behavioral inhibition* (pp. 237–261). Cham, Switzerland: Springer.

Pérez-Edgar, K., & Bar-Haim, Y. (2010). Application of cognitive-neuroscience techniques to the study of anxiety-related processing biases in children. In J. Hadwin & A. Field (Eds.), *Information processing biases in child and adolescent anxiety* (pp. 183–206). Chichester, UK: John Wiley & Sons.

Pérez-Edgar, K., & Fox, N. A. (2005). Temperament and anxiety disorders. *Child and Adolescent Psychiatric Clinics of North America, 14*, 681–706. https://doi.org/10.1016/j.chc.2005.05.008

Pérez-Edgar, K., & Fox, N. A. (2018). Next steps: Behavioral inhibition as a model system. In *Behavioral inhibition* (pp. 357–372). Cham, Switzerland: Springer.

Pérez-Edgar, K., & Guyer, A. E. (2014). Behavioral inhibition: Temperament or prodrome? *Current Behavioral Neuroscience Reports, 1*(3), 182–190.

Pérez-Edgar, K., & Hastings, P. D. (2018). Emotion development from an experimental and individual differences lens. In J. T. Wixted & S. Ghetti (Eds.), *Stevens' handbook of experimental psychology and cognitive neuroscience* (Vol. 4, 4th ed., pp. 289–321). New York: Wiley.

Pérez-Edgar, K., Roberson-Nay, R., Hardin, M. G., Poeth, K., Guyer, A. E., Nelson, E. E., … Ernst, M. (2007). Attention alters neural responses to evocative faces in behaviorally inhibited adolescents. *NeuroImage, 35*, 1538–1546.

Pérez-Edgar, K., Taber-Thomas, B., Auday, E., & Morales, S. (2014). Temperament and attention as core mechanisms in the early emergence of anxiety. In K. Lagattuta (Ed.), *Children and emotion: New insights into developmental affective science* (Vol. 26, pp. 42–56). Basel, Switzerland: Karger Publishing.

Perry, N. B., & Calkins, S. D. (2018). A biopsychosocial perspective on the development of emotion regulation across childhood. In *Emotion regulation* (pp. 21–48). New York: Routledge.

Putnam, S. P., & Rothbart, M. K. (2006). Development of short and very short forms of the Children's Behavior Questionnaire. *Journal of Personality Assessment, 87*, 102–112.

Reynolds, G., Askew, C., & Field, A. P. (2018). Behavioral inhibition and the associative learning of

fear. In *Behavioral inhibition* (pp. 263–282). Cham, Switzerland: Springer.

Root, A. K., & Stifter, C. (2010). Temperament and maternal emotion socialization beliefs as predictors of early childhood social behavior in the laboratory and classroom. *Parenting: Science and Practice, 10*(4), 241–257.

Rothbart, M. K. (2012). Advances in temperament: History, concepts, and measures. In M. Zentner & R. L. Shiner (Eds.), *Handbook of temperament* (pp. 3–20). New York: Guilford Press.

Rothbart, M. K., & Bates, J. E. (2007). Temperament. In W. Damon & N. Eisenberg (Eds.), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development* (pp. 105–176). New York: Wiley.

Rothbart, M. K., Calkins, S., Gunnar, M., Kalin, N., Panksepp, J., & Reiman, E. (2001). Emotion and temperament. *Developmental Science, 4*(3), 313–329.

Rothbart, M. K., & Derryberry, D. (1981). Development of individual differences in temperament. In M. E. Lamb & A. L. Brown (Eds.), *Advances in developmental psychology* (Vol. 1, pp. 37–86). Hillsdale, NJ: Erlbaum.

Rothbart, M. K., Ellis, L., & Posner, M. (2004). Temperament and self-regulation. In R. Baumeister & K. Vohs (Eds.), *Handbook of self-regulation: Research, theory, and applications* (pp. 357–370). New York: Guilford Press.

Rothbart, M. K., Sheese, B. E., Rueda, M. R., & Posner, M. I. (2011). Developing mechanisms of self-regulation in early life. *Emotion Review, 3*, 207–213. https://doi.org/10.1177/1754073910387943

Rothbart, M. K., Ziaie, H., & O'Boyle, C. (1992). Self-regulation and emotion in infancy. In N. Eisenberg & R. A. Fabes (Eds.), *Emotion and its regulation in early development* (Vol. 55, pp. 7–23). San Francisco, CA: Jossey-Bass.

Roy, A. K., Klein, R. G., Angelosante, A., Bar-Haim, Y., Leibenluft, E., Hulvershorn, L., … Spindel, C. (2013). Clinical features of young children referred for impairing temper outbursts. *Journal of Child and Adolescent Psychopharmacology, 23*(9), 588–596.

Rubin, K. H., Barstead, M. G., Smith, K. A., & Bowker, J. C. (2018). Peer relations and the behaviorally inhibited child. In *Behavioral inhibition* (pp. 157–184). Cham, Switzerland: Springer.

Rubin, K. H., Burgess, K., & Hastings, P. (2002). Stability and social-behavioral consequences of toddlers' inhibited temperament and parenting behaviors. *Child Development, 73*, 483–495.

Rubin, K. H., Hymel, S., Mills, R. S. L., & Rose-Krasnor, L. (2014). Conceptualizing different developmental pathways to and from social isolation in childhood. In D. Cicchetti & S. L. Toth (Eds.), *Internalizing and externalizing expressions of dysfunction* (Vol. 2, pp. 91–122). New York: Psychology Press.

Rubin, K. H., Nelson, L. J., Hastings, P., & Asendorpf, J. (1999). The transaction between parents' perceptions of their children's shyness and their parenting styles. *International Journal of Behavioral Development, 23*(4), 937–957.

Rueda, M. R. (2012). Effortful control. In M. Zentner & R. L. Shiner (Eds.), *Handbook of temperament* (pp. 145–168). New York: Guilford Press.

Saudino, K. J., & Eaton, W. O. (1991). Infant temperament and genetics: An objective twin study of motor activity level. *Child Development, 62*(5), 1167–1174.

Schwartz, C. E., Kunwar, P., Greve, D. N., Kagan, J., Snidman, N. C., & Bloch, R. (2012). A phenotype of early infancy predicts reactivity of the amygdala in male adults. *Molecular Psychiatry, 17*(10), 1042.

Schwartz, C. E., Wright, C. I., Shin, L. M., Kagan, J., & Rauch, S. L. (2003). Inhibited and uninhibited infants "grown up": Adult amygdalar response to novelty. *Science, 300*, 1952–1953.

Sheese, B. E., Rothbart, M. K., Posner, M. I., White, L. K., & Fraundorf, S. H. (2008). Executive attention and self-regulation in infancy. *Infant Behavior and Development, 31*, 501–510.

Shiner, R. L., Buss, K. A., McClowry, S. G., Putnam, S. P., Saudino, K. J., & Zentner, M. (2012). What is temperament now? Assessing progress in temperament research on the twenty-fifth anniversary of Goldsmith et al. (1987). *Child Development Perspectives, 6*(4), 436–444.

Soto, J. A., Lee, E. A., & Roberts, N. A. (2016). Convergence in feeling, divergence in physiology: How culture influences the consequences of disgust suppression and amplification among European Americans and Asian Americans. *Psychophysiology, 53*(1), 41–51.

Sroufe, L. A. (1997). *Emotional development: The organization of emotional life in the early years*. Cambridge: Cambridge University Press.

Sroufe, L. A., & Rutter, M. (1984). The domain of developmental psychopathology. *Child Development, 55*, 17–29.

Stifter, C. A., Dollar, J. M., & Cipriano, E. A. (2011). Temperament and emotion regulation: the role of autonomic nervous system reactivity. *Developmental Psychobiology, 53*(3), 266–279.

Stifter, C. A., Putnam, S., & Jahromi, L. (2008). Exuberant and inhibited toddlers: Stability of temperament and risk for problem behavior. *Development and Psychopathology, 20*(2), 401–421.

Sylvester, C. M., & Pine, D. S. (2018). The biological bridge between behavioral inhibition and psychopathology. In *Behavioral inhibition* (pp. 309–335). Cham, Switzerland: Springer.

Thomas, A., & Chess, S. (1977). *Temperament and development*. Oxford, England: Brunner/Mazel.

Tronick, E. Z. (1989). Emotions and emotional communication in infants. *American Psychologist, 44*(2), 112.

Tsotsi, S., Broekman, B. F., Shek, L. P., Tan, K. H., Chong, Y. S., Chen, H., … Rifkin-Graboi, A. E. (2019). Maternal parenting stress, child exuberance, and preschoolers' behavior problems. *Child Development, 90*(1), 136–146.

Ungar, M. (2009). Overprotective parenting: Helping parents provide children the right amount of risk and responsibility. *The American Journal of Family Therapy, 37*(3), 258–271.

van der Bruggen, C. O., Stams, G. J. J., & Bögels, S. M. (2008). Research review: The relation between child and parent anxiety and parental control: a meta-analytic review. *Journal of Child Psychology and Psychiatry, 49*(12), 1257–1269.

Wang, Q. (2013). *The autobiographical self in time and culture*. New York: Oxford University Press.

Wang, Q., & Brockmeier, J. (2002). Autobiographical remembering as cultural practice: Understanding the interplay between memory, self and culture. *Culture & Psychology, 8*, 45–64. https://doi.org/10.1177/1354067X02008001618

Wass, S. V., Clackson, K., & Leong, V. (2018). Increases in arousal are more long-lasting than decreases in arousal: On homeostatic failures during emotion regulation in infancy. *Infancy, 23*(5), 628–649.

Wellman, H. M., Cross, D., & Watson, J. (2001). Meta-analysis of theory-of-mind development: The truth about false belief. *Child Development, 72*(3), 655–684.

Witherspoon, D. P., Daniels, L. L., Mason, A. E., & Smith, E. P. (2016). Racial-ethnic identity in context: Examining mediation of neighborhood factors on children's academic adjustment. *American Journal of Community Psychology, 57*(1–2), 87–101.

Wood, J. J. (2006). Parental intrusiveness and children's separation anxiety in a clinical sample. *Child Psychiatry and Human Development, 37*(1), 73–87.

Zalewski, M., Lengua, L. J., Wilson, A. C., Trancik, A., & Bazinet, A. (2011). Emotion regulation profiles, temperament, and adjustment problems in preadolescents. *Child Development, 82*(3), 951–966.

Part II

Expression of Individual Emotions

Happiness and Joy

Daniel Messinger, Samantha G. Mitsven, Yeojin Amy Ahn, Emily B. Prince, Lei Sun, and Camila Rivero-Fernández

Abstract

Happiness and joy involve feelings of positive engagement which are prototypically expressed through the face, voice, and body. Joyful smiles tend to be strong and involve both eye constriction (the Duchenne marker) and mouth opening. Through approximately 2 months of age, joyful expressions are primarily rooted in physiological arousal. Positive emotional expressions then quickly become more social, occurring in face-to-face interactions with caregivers as infants increasingly derive psychological meaning from individuals and events. Beginning in the second half of the first year of life, infants' expressions of positive emotion are increasingly incorporated into patterns of intentional communication. Between 1 and 2 years of age, positive expressivity is increasingly responsive to parental affective cues during pretense play. Preschoolers' between 2 and 5 years of age utilize specific forms of positive emotion expressions to foster affiliation with their peers. By 8 years of age, children voluntarily control their expressions of positive emotion depending on the interpersonal context. These early expressions of joy are associated with later social competence, including reduced behavioral inhibition and reticence in reaction to novelty, compliance with parental requests, tolerance of new experiences, and attachment security. Further, positive expressivity is also linked to later life outcomes, primarily life satisfaction and overall well-being in adulthood. Positive emotion expression varies as a function of gender as well as cultural differences in the emotional significance and perceptions of positive expressions. Finally, the development of joyful expressivity is differentially sensitive to a variety of risk conditions, including maternal depression, prematurity, infant blindness, Down syndrome, and autism spectrum disorder.

Overview Happiness and its more intense and short-lived companion joy refer to positive subjective states ranging from contentment to elation (Ruch, 1993). In infancy, happiness and joy appear to be inextricably associated with characteristic expressive actions such as smiling and laughter which communicate a readiness for positive engagement (Sauter, McDonald, Gangi, & Messinger, 2014). Happiness and joy can be expressed by facial expressions such as smiling,

Work on this chapter was supported by the NIH (R01GM105004) and NSF (IBSS 1620294).

D. Messinger (✉) · S. G. Mitsven · Y. A. Ahn
E. B. Prince · L. Sun · C. Rivero-Fernández
University of Miami, Department of Psychology, Miami, FL, USA
e-mail: dmessinger@miami.edu

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_8

positive vocalizations such as laughter, and ebullient body movement, as well as by self- and other report. Smiling and laughter are perhaps the most specific indices of happiness and joy, and the bulk of the chapter is devoted to these expressions. An initial overview of theoretical perspectives on the development of happiness and joy sets the stage for a review of behavioral expressions of happiness and joy.

Theoretical Perspectives on the Development of Positive Emotion

Cognitive differentiation theory Cognitive differentiation theory holds that joy involves awareness of the pleasure afforded by active engagement with the environment (Sroufe, 1995; Tomkins, 1962). Infants' active cognitive engagement with environmental events, and maybe even early awareness of their own pleasure, is thought to be necessary for the emergence of joy (Barrett, 2006; Bridges, 1932; Sroufe, 1995). Cognitive differentiation theory holds that joy develops out of more diffuse states of pleasurable positive valence prevalent through approximately 6 months of age. Joy itself is held to develop around 9 months of age and is characterized by pronounced drops in cognitively mediated arousal which might occur, for example, during pretend play and is accompanied by intense smiling and laughing (Sroufe, 1995).

Discrete emotion theory In contrast to a cognitive differentiation perspective, discrete emotion theory posits a brain-based affect program of joy/happiness which organizes the output of multiple expressive systems. Smiles and laughter are thought to express a core joyful feeling state from infancy through childhood, adolescence, and the remainder of the lifespan (Ackerman, Abe, & Izard, 1998; Izard & Ackerman, 2000; Lewis, 2000). Discrete emotion theory, like the functionalist approach described next, holds that joy motivates social approach and interaction and facilitates social cohesion.

Functionalist theory While discrete theories hold that joy resides within the individual, functionalist and dynamic theories argue that joy and other emotions exist in the relationship of the child to the social surround (Barrett, 1993; Campos, Mumme, Kermoian, & Campos, 1994; Witherington, Campos, & Hertenstein, 2001). Functionalist perspectives emphasize the adaptive role of happiness and joy in creating and maintaining relationships with social partners throughout development. Ethological research, guided by a functionalist perspective, has illustrated the communicative functions of smiles and other expressions in monkeys and apes, as well as human beings (Bard, 1992; Burrows, Waller, Parr, & Bonar, 2006; Mizuno, Takeshita, & Matsuzawa, 2006; Redican, 1975; van Hooff, 1972). From one functionalist perspective, for example, early smiles are attachment behaviors whose function is to maintain caregivers in proximity to the infant (Bowlby, 1982).

Dynamic systems theory This chapter uses a dynamic systems perspective as a superordinate orientation to integrate insights from other theoretical perspectives (Camras, 2000; Fogel et al., 1992; Messinger, Fogel, & Dickson, 1997; Thelen & Smith, 1994; Thelen & Ulrich, 1991; Witherington et al., 2001). A dynamic systems approach holds that positive emotion expressions are part and parcel of emotional processes. That is, smiling is both a constituent of the experience of joy and a component of emotional communication with others.

Summary These theoretical approaches provide contrasting definitions of positive emotion and insights into the empirical literature on the development of happiness and joy. Each approach also speaks to the clarity of behavioral evidence needed to infer happiness and joy. Below, we review evidence for the behavioral expressions of happiness and joy, which guide the presentation of empirical results in this chapter, and then consider the neurophysiology and genetics of happiness.

Behavioral Expressions of Happiness and Joy

Smiles Infants express positive emotions such as happiness and joy through facial expressions, vocalizations, touch, and physical movement. Early smiles are often perceived as direct expressions of joyful feelings (see Fig. 1). The apparent association between positive emotion and its expressions has motivated research on the emotional significance, causes, behavioral correlates, and developmental consequences of early smiling. Piaget (1952) argued that a mastery smile indexed feelings of pleasurable accomplishment, while Darwin (1872/1998) concluded that the early waking smiles of his own infants were expressions of joy.

Laughter Positive vocalizations that index happiness and joy include laughter and non-laughter vocalizations. Laughter is a rhythmic vocalization which occurs during open-mouth smiles and indexes intense positive emotion such as joy (Sroufe & Waters, 1976). Tickling and other physically stimulating games are frequent elicitors of laughter in nonhuman as well as human primate infants (Davila-Ross, Jesus, Osborne, & Bard, 2015; Owren & Amoss, 2014). Laughter emerges between 2 and 5 months and becomes more frequent through 24 months of age (Nwokah, Hsu, Dobrowolska, & Fogel, 1994; Washburn, 1929). Initial laughs sound much like early vowel-like vocalizations, but mothers recognize and comment on them (Nwokah & Fogel, 1993). Between 6 and 12 months of age, infants become more active participants in social games such as peekaboo and are more likely to laugh during these games (Sroufe & Waters, 1976). From 1 and 2 years of age, infant and mother laugh onsets and offsets occur increasingly close in time, suggesting increasing coordination of joyful exchanges (Nwokah et al., 1994).

Fig. 1 This 6-month-old infant's strong smile involves the Duchenne marker (eye constriction) and mouth opening

Positive non-laughter vocalizations Non-laughter vocalizations include gurgling, positively toned babbling, and cooing, which are used to index positive affect in observational research on infant temperament (Fox, Henderson, Rubin, Calkins, & Schmidt, 2001; Goldsmith & Rothbart, 1999; Hane, Fox, Henderson, & Marshall, 2008). However, validation of the emotional specificity of these vocalizations is limited to their face validity and the longitudinal associations of the broader temperament dimensions they help index. In the context of smiling, many infant vocalizations seem to convey happiness and joy. Judges exhibit only moderate agreement when rating the affective tone of infant vocalizations from audio alone (Oller et al., 2013), although agreement increases when observers watch the infant as they listen to their vocalization (Franklin, Oller, Ramsdell, & Jhang, 2011). Yale (2003) found that infants tended to smile, and then vocalize during the course of the smile, finishing the vocalization before ending the smile. When infant's non-laughter vocalizations are temporally embedded in smiles, they appear to emphasize or accentuate the communication of positive emotion (Hsu, Fogel, & Messinger, 2001; Yale, Messinger, & Cobo-Lewis, 2003).

Body movement and positive touch Darwin observed that children may tremble with joy, clap their hands with joy, and jump for joy (Darwin, 1872/1998). In the Lab-TAB measure of infant and child temperament, clapping, excited arm waving, and banging one's hands on a table are identified as positive motor activities (Goldsmith & Rothbart, 1999) because they occur during joy/

pleasure episodes designed to elicit positive emotion. Although there has been little research on the degree to which body movement indexes positive emotion, touch may be a preferred mode of communicating prosocial emotions. Between 7 and 11 months, infants increasingly display affectionate touch dynamically by patting, hugging, and kissing the caregiver (Landau, 1989). More generally, warm, comfortable touch between infants and caregivers bolsters infants' regulation of arousal (Feldman, Singer, & Zagoory, 2010) and is associated with positive developmental outcomes such as secure attachment (Anisfeld, Casper, Nozyce, & Cunningham, 1990; Weiss, Wilson, Hertenstein, & Campos, 2000). In older children (5- and 6-year-olds), smile intensity is associated with warm family touch (Oveis, Gruber, Keltner, Stamper, & Boyce, 2009), suggesting positive emotional interaction between child and parents.

The Neurophysiology and Genetics of Happiness

The neurophysiology of smiling Heart rate is more rapid during infant smiling than during neutral expressions (Emde, Campos, Reich, & Gaensbauer, 1978), a pattern also seen in adults (Cacioppo, Berntson, Larsen, Poehlmann, & Ito, 2000). Anatomically, zygomaticus major contraction creates a smile by pulling the corners of the lips upward and to the side (see Fig. 1). The zygomaticus major is innervated by the facial nerve (Elliot, 1969), which emanates from the facial motor nucleus located in the brainstem (Williams, Warick, Dyson, & Bannister, 1989). The facial motor nucleus receives inputs from one neural pathway involved in deliberate smiling and another involved in spontaneous smiling (Rinn, 1984). Spontaneous smiling, which is associated with happiness and joy, involves an extrapyramidal pathway stemming from the basal ganglia.

The neurophysiology of happiness and joy Unexpectedly, meta-analyses of neuroimaging studies of adults have not unambiguously identified regions of interest activated by positive emotions (Barrett & Wager, 2006), although the ventromedial prefrontal cortex (Lindquist, Satpute, Wager, Weber, & Barrett, 2016), the anterior cingulate cortex (Murphy, Nimmo-Smith, & Lawrence, 2003), and the basal ganglia (Phan, Wager, Taylor, & Liberzon, 2004) are candidate structures. More robust evidence suggests an association of joy and other approach-related emotions with laterality differences in cerebral activation (Barrett & Wager, 2006). Emotions involving approach motivation, particularly joy, are associated with greater left than right frontal cerebral activation (Murphy et al., 2003). Laterality differences, combined with an absence of robust structural candidates, suggest a distributed cerebral basis for positive emotions, one which may involve distributed activation networks.

Environmental variability overshadows inherited variability Parent reports of infant temperament involving expressions of happiness and joy (indexed by questions about smiling and laughter) have revealed both genetic and environmental effects (Goldsmith, Buss, & Lemery, 1997; Goldsmith, Lemery, Buss, & Campos, 1999). These results contrast with questions about infants' expression of negative emotions, which show higher genetic and lower environmental effects. A recent report suggested an even more striking contrast (Planalp, Van Hulle, Lemery-Chalfant, & Goldsmith, 2017). Observed and parent-reported positive affect was assessed at 6 and 12 months in a large sample of mono- and dizygotic twins. Genetic (inherited) variability was not detectable in either measure at either age. By contrast, shared environmental variance was associated with both observed and reported positive affect at both ages. The findings underscore the role of family socialization processes in the development of individual differences in happiness and joy. In fact, by 12 months, observed positive affect was positively associated with mothers' reports of their own positive affect and of family positive affect. These findings underline

the role of emotional socialization and interpersonal positivity in the development of happiness and joy. Below, we consider evidence for different expressions of happiness and joy, before reviewing the development of these expressions.

Joyful Positive Emotion: The Heterogeneity of Smiling and Positive Vocalizations

Smiles are prototypical expressions of happiness but vary in strength and form. All types of smiles, at least in infancy, appear to express happiness, although stronger smiles and smiles involving eye constriction and mouth opening are more joyful than smiles without these characteristics (Messinger, Fogel, & Dickson, 2001). Smiles and laughter are part and parcel of positive emotional engagement with the social environment. Below, we review findings suggesting that different types of smiling express different degrees, and perhaps forms, of happiness and joy.

Variation in expressions of happiness and joy Smiles vary in strength and form, and these features are associated with variations in the expression of happiness and joy. Smiles can be stronger or weaker, and they can involve eye constriction (the Duchenne marker) and mouth opening to varying degrees. Smiles are often classified as to whether they do (Duchenne smiles) or do not (non-Duchenne smiles) involve eye constriction and mouth opening. However, all features of smiles vary continuously. Smiles can involve more or less eye constriction (the Duchenne marker) and mouth opening.

Simple smiles The strength of a smile varies with the contraction of the zygomaticus major. Smiles which do not involve Duchenne eye constriction or mouth opening, particularly when they are characterized by weaker smiling action, may be referred to as simple smiles. Simple smiles are more likely to occur during situations thought to elicit happiness (Messinger et al., 2001) and are perceived as more happy than neutral expressions (Messinger, 2002). However, simple smiles appear to share functional similarities with the bared teeth display of chimpanzees (pan troglodyte), which appear to signal affiliation (Burrows et al., 2006; Plooij, 1979; Redican, 1975). Likewise, simple smiles may communicate a readiness for positive affiliation which may lead to more positive engagement. In infants, simple smiles tend to occur, for example, when infants are approached by an impassive stranger (Fox & Davidson, 1988).

Open-mouth smiles Smiles involving mouth opening are caused by jaw dropping and are sometimes referred to as play smiles. In infancy, they are typically elicited by social engagement and may reflect excited states. Open-mouth smiles are most likely to occur while infants look at their mothers' faces and are perceived as indexing more positive emotion and more arousal than closed-mouth smiles (Messinger, Mattson, Mahoor, & Cohn, 2012). The human open-mouth smile is morphologically similar to the relaxed open-mouth display of nonhuman primates (Davila-Ross et al., 2015; Waller & Dunbar, 2005). Among infant chimpanzees, these displays are thought to develop during mock biting play with mothers (Plooij, 1979) and, later in life, are most likely to occur during rough play that involves physical contact with a conspecific (Davila-Ross et al., 2015). As in human infants, open-mouth smiles communicate aroused, playful engagement and are a frequent context for laughter (Davila-Ross et al., 2015; Nwokah et al., 1994; Nwokah, Hsu, Davies, & Fogel, 1999; Sroufe & Waters, 1976).

Duchenne smiles The Duchenne marker is the best recognized index of positive emotional intensity from infancy through adulthood. In Duchenne smiles, eye constriction caused by orbicularis oculi, pars lateralis, raises the cheeks toward the eyes and, in adults, produces crow's feet wrinkles (Duchenne, 1990/1862). Infants produce Duchenne smiles when approached by their smiling mothers and, during face-to-face

interaction, when their mothers are smiling (Fox & Davidson, 1988). Although not apparent in a high-risk sample (Mattson, Ekas, et al., 2013), infant smiling in a mid-SES (socioeconomic status) sample was more likely to involve the Duchenne marker in face-to-face interaction than when parents hold a still-face, which reduces infant positive affect (Mattson, Cohn, Mahoor, Gangi, & Messinger, 2013). Duchenne smiling is also associated with greater left than right frontal cerebral activation, a pattern indexing higher levels of approach orientation and joy (Fox & Davidson, 1988). Infants produce more syllabic vocalizations during Duchenne smiling, which may index positive emotional intensity. Duchenne smiles are often regarded as the only veridical index of joyful emotion in adults (Ekman, Davidson, & Friesen, 1990); however, this distinction does not appear to be absolute. In infants, Duchenne smiling is likely to follow non-Duchenne smiling, suggesting that infant Duchenne smiles are more joyful that non-Duchenne smiles (Messinger, Fogel, & Dickson, 1999).

Strong smiles Smiles are continuous processes. The extent of zygomaticus major contraction determines the degree of lip corner movement involved in a smile and determines its strength. Stronger smiles index more intense happiness and joy and the infant's positive engagement with ongoing play. The climax phase of games, for example, is associated with stronger smiling than the preparatory phase of games (Fogel, Hsu, Shapiro, Nelson-Goens, & Secrist, 2006). Parental tickling elicits stronger smiling than getting ready or pretending to tickle. Stronger smiles are perceived as more joyful than weaker smiles. Stronger smiles involving greater zygomaticus major contraction tend to also involve eye constriction and, at least in infancy, mouth opening (Messinger et al., 1999). Smiles without eye constriction and mouth opening tend to involve the weakest zygomatic contraction, while the strongest smiles tend to involve both eye constriction and mouth opening (see Fig. 2). These intensity parameters vary together dynamically during the course of an infant smile. In infancy, as a smile becomes stronger and weaker, the strength of eye constriction

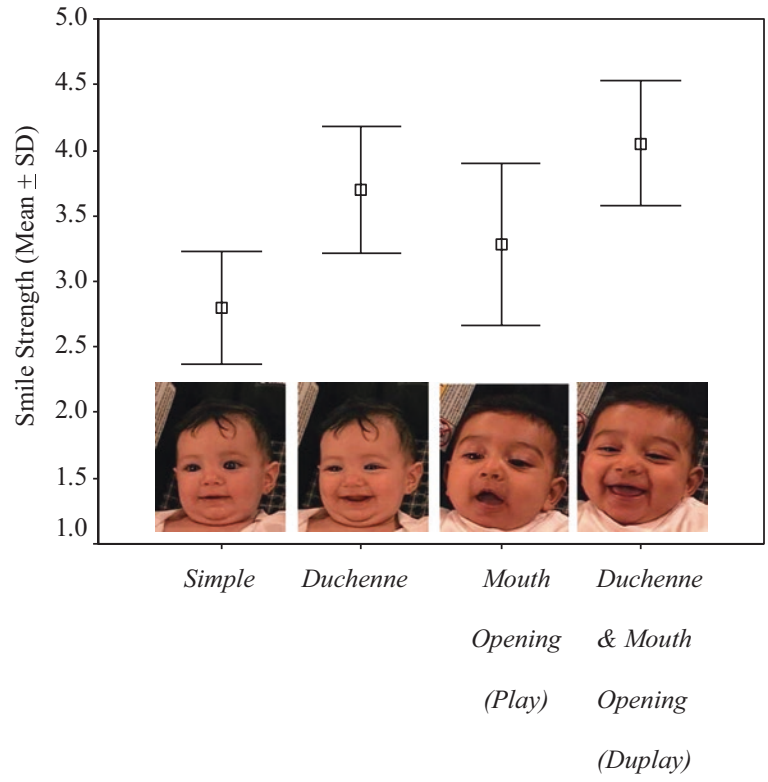

Fig. 2 Mean smile strength of different smile types

and degree of mouth opening involved in the smile increase and decrease as well.

Combined strong, open-mouth Duchenne smiles In infancy, smiles involving the Duchenne marker tend to involve mouth opening as well (see Fig. 1) (Messinger et al., 1999). These combined smiles tend to occur during especially positive periods of interaction such as when infants gaze at their smiling mothers (Messinger et al., 2001). Strong infant smiles involving both eye constriction and mouth opening are perceived as the most joyful (Messinger et al., 2012). They are most likely to occur in contexts—during tickling (Fogel et al., 2006) and during physical play with parents (Dickson, Walker, & Fogel, 1997)—which are likely to elicit the highest degree of arousal and joy.

Happiness, joy, and the heterogeneity of smiling Inferences of happiness and joy depend not only on smiles and other expressive behaviors but also on the emotional context in which the expressions occur, as well as simultaneous patterns of central and peripheral nervous system activity. Drawing on these sources of evidence, it is possible to provide a preliminary overview of the relationship of different types of smiling and laughter to different positive emotions. Stronger smiles and smiles that involve both eye constriction (the Duchenne marker) and mouth opening are most likely to index joy, while weaker smiles and smiles without eye constriction and mouth opening are more likely to index lower intensities of happiness.

The Development of Happiness and Joy Expressions

Developmental overview The development of happiness and joy reflects the emerging cognitive, emotional, and social competencies of infants and young children. Smiles quickly become a centerpiece of face-to-face social interactions in the first 6 months of life, where their morphology and context increasingly support the view that they index happiness and joy. In the second half of their first year, infants come to understand and use smiles as communications of positive affect. They communicate happiness and joy more intentionally outside of the dyad with their direct communicative partners. Between 1 and 4 years, children become more aware of the social meanings of their parents' smiles. Between 4 and 8 years, children increasingly engage in peer play and use different types of smiles for different functions with peers and with adults. Finally, early expressions of joy show associations with social competence, while later self-presentation of joyful expressions in photographs is associated with positive life outcomes.

Neonatal and Early Smiling: 0–2 Months

Neonatal smiles occur most frequently not only in sleeping/drowsy states of rapid eye movement (REM) but also in states of alertness, suggesting a possible association with positive emotion (Dondi et al., 2007). Although typically prompted by internal stimuli, the form of neonatal smiles suggests an association with positive emotion. Neonatal smiles occur in the context of other lip and mouthing movements, but one-third of neonatal smiles are recognized as smiles by untrained observers (Dondi et al., 2007). Neonatal smiles can have a relatively mature form that involves strong muscular contractions and the Duchenne marker (Dondi et al., 2007; Messinger et al., 2002). However, the neonatal smile emerges before it is integrated into patterns of environmental engagement and social interaction which would provide stronger evidence for joyful emotion.

Early Smiling and the Transition to Social Smiling: 1–2 Months

Toward 1 month of age, smiles during sleep decrease in frequency, while stronger smiles during alert states increase (Harmon & Emde, 1972; Wolff, 1987). A similar pattern has been observed in infant chimpanzees, who show a decline in neonatal smiling during REM sleep and an increase in social smiling when awake (Mizuno et al., 2006). In the second month of life, social smiling emerges as infants spend more time in awake alert states that enable gazing at a caregiver's face and facilitate interaction (Lavelli & Fogel, 2005). Early social smiles are typically preceded by a 3–20-second period of brow knitting and gazing at the mother's face, followed by relaxation of the brows (Anisfeld, 1982; Lavelli & Fogel, 2005; Oster, 1978). This suggests that the first expressions of happiness are preceded by a period of concentrated effort, which may be linked to visual recognition of the parent. While neonatal smiles appear to be driven by physiological arousal, early social smiles appear to be more cognitively driven, occurring when infants recognize external stimuli as psychologically meaningful. Parents, in turn, feel recognized and rewarded by these first social smiles, setting the stage for the development of social smiling in face-to-face interactions.

The Development of Social Smiling in Face-to-Face Interaction: 2–6 Months

Overview of joyful interaction Infant expressions of joy and happiness develop during interaction. In the period between 2 and 6 months, infants become both increasingly likely to initiate smiles and increasingly likely to respond to their partners' smiles (Cohn & Tronick, 1987). Approximately one-fifth of the duration of face-to-face interaction involves infant smiling (Malatesta, Culver, Tesman, & Shepard, 1989; Messinger et al., 2001), and smiles are most likely when infants are gazing at the caregiver's face (Fig. 3). Parents often aim to amplify their infants' joyful experiences during interaction (Cohn & Tronick, 1987; Feldman, 2003; Feldman & Greenbaum, 1997; Feldman, Greenbaum, & Yirmiya, 1999; Feldman, Greenbaum, Yirmiya, & Mayes, 1996; Fogel, 1988, 1993). Parents smile and laugh, touch the infant, and use high-pitched infant-directed speech to elicit infant smiles and laughter. Parents' multimodal displays increase and decrease in intensity together with and in reaction to their infants' joyful expressions.

Mothers and fathers Infant expressions of happiness are peak moments of play with both moth-

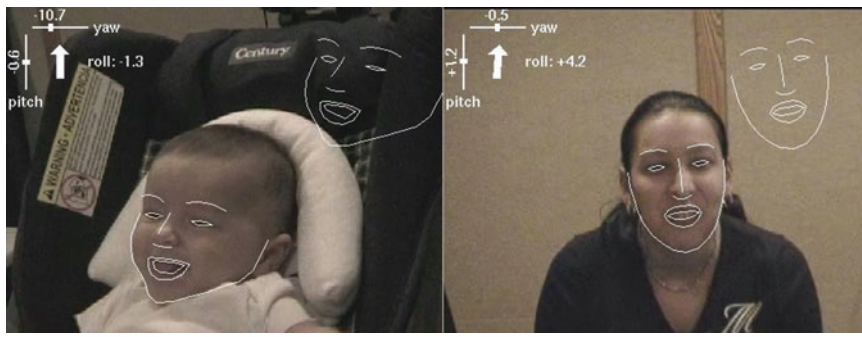

Fig. 3 Four-month-old infant and mother smiling interaction as captured by Automated Face Analysis at the Carnegie Mellon University, Robotics Institute, compliments of Jeffrey Cohn, Ph.D. The infant and mother's faces are outlined to illustrate lip movement, mouth opening, and eye constriction

ers and fathers. However, differences in mothers' and fathers' play may influence the temporal patterning of infants' positive displays. Fathers tend to engage in more physical play with infants (e.g., bouncing games), whereas mothers engage in a more visually and vocally expressive style of play (Dickson et al., 1997). Perhaps as a consequence, infants' positive emotional expressions build more gradually during interactions with mothers and appear more suddenly during interactions with fathers (Feldman, 2003).

Infant and mother responsivity to smiling Expressions of happiness and joy during infancy are often assessed during interaction with a parent and in the face-to-face/still-face protocol (FFSF). In the FFSF, an episode of face-to-face play is followed by an episode in which the parent is asked to not interact with the infant (to hold a still-face), which is followed by a final reunion episode in which the parent is asked to play again with the infant (Adamson & Frick, 2003; Mesman, van IJzendoorn, & Bakermans-Kranenburg, 2009). Smiling declines logarithmically during the course of the still-face (Ekas, Haltigan, & Messinger, 2013) and rises in the reunion episode, though not quite to initial face-to-face levels.

Contingent responsiveness Parental contingent responses during face-to-face interactions provide a framework from which infants develop an understanding of themselves as effective agents in instigating positive interactions with others. Mothers with higher rates of vocal contingent responsiveness to their 2–3-month-old infants have infants who display more smiles in the still-face than infants whose mothers have lower rates of vocal contingent responsiveness (Bigelow & Power, 2016). Additionally, infants who have higher durations of smiling during face-to-face interactions with their mother at 2 and 3 months of age produce more smiles and non-distress vocalizations when their mother becomes nonresponsive in the still-face, likely in an attempt to reengage their mother in positive social interaction (Bigelow & Power, 2016).

Interaction Interaction suggests that each partner responds to and is responsive to the other. In infancy, this responsiveness is asymmetrical. Infant smiles are reliable elicitors of mother smiles, typically within a 2-second time window (Malatesta & Haviland, 1982; Van Egeren, Barratt, & Roach, 2001). However, mother smiles are less reliable elicitors of infant smiles (Cohn & Tronick, 1987; Kaye & Fogel, 1980; Messinger, Ruvolo, Ekas, & Fogel, 2010), and mothers frequently initiate smiles when infants are not smiling (Messinger et al., 2010). Mothers appear most likely to elicit infant smiles when they combine their own smiling with other behaviors from multiple communicative modalities, such as vocalizing, leaning toward the infant, kissing, and tickling (Beebe & Gerstman, 1984; Mendes & Seidl-de-Moura, 2014; Messinger, Mahoor, Chow, & Cohn, 2009). Although parents contingently respond to infant smiles, infants may experience these contingent parent smiles in the midst of many noncontingent smiles and other parental expressive behaviors (Symons & Moran, 1994).

Primary intersubjectivity In addition to exchanges of discrete smiles, infant and mother appear to continuously affect one another's joyful expressions (Messinger et al., 2009). Stronger infant smiling is typically mirrored by stronger mother smiling. While stronger smiling on the mother's part may be mirrored by the infant, the infant may also gaze away from the mother and decrease or terminate smiling to regulate their levels of arousal (Chow, Haltigan, & Messinger, 2010; Stifter & Moyer, 1991). The dyadic smiling states that occur between infants and mothers represent a nonverbal dialogue in which the topic is the shared experience of joy and the regulation of intense experiences of positive emotion. When caregivers mirror their infants' smiles in an intensified form, infants internalize the increase in positive emotion reflected in their parent's smile while simultaneously perceiving an increase in their own positive emotion. Neurophysiological processes implicated in producing feelings of sym-

pathetic joy, including mirror neurons, may be responsible for infants' contingent positive responsiveness to their parent's positive expressivity. Early interactions in which infants are able to observe the impact of their own behaviors on their parents lay the foundation for infants to develop an awareness of changes in their own experiences of joy. The dynamic interplay that results in which the infant is simultaneously aware of their own as well as their social partner's feelings suggests that one path to the development of joy involves experiencing the joy of another, a process known as primary intersubjectivity.

Perceptions of joy Infants' perception of others' smiles indexes the positive emotional content of their own smiles. By 3 months, infants associate their mothers' smiles with their mothers' positive vocal expressions in viewing tasks. That is, they gazed longer (two thirds of the time) and expressed more positive affect (over 4 on a 5-point scale) while gazing at the mother's smile expression when it occurred with a positive vocalization (Kahana-Kalman & Walker-Andrews, 2001). At 4 months, infants showed evidence for perceiving the same facial-vocal correspondence to an unfamiliar adult—specifically, increasing looking time when positive (facial-vocal) expressions were followed by (facial-vocal) negative expressions—during several cycles of a peekaboo game (Montague & Walker-Andrews, 2002). Finally, by 7 months infants show a greater propensity to gaze toward a static smiling expression after being habituated to a static sad expression (and vice versa) (Leppänen, Richmond, Vogel-Farley, Moulson, & Nelson, 2009). The results point to the importance of person familiarity and shared routines in understanding affective expressions (Kahana-Kalman & Walker-Andrews, 2001). More generally, they suggest that infants' understanding of other's expressions emerges in the same period in which infants come to more flexibly utilize their own expressions of joy.

Why infants smile Infants' and mothers' goals during dyadic interactions can be inferred from the patterns of consequences of their smiling (and not smiling) using an inverse optimal modeling framework (Ruvolo, Messinger, & Movellan, 2015). This framework indicated that mothers' actions were most consonant with the goal of increasing time in mutual smiling. Infants' actions—including smiling briefly until the mother smiled and then not smiling—were most consonant with the goal of increasing time when the mother was smiling but the infant was not. The findings are disconcerting in part because they suggest that infants are not simply acting to increase time in expressions of happiness; rather, their smiling actions involve creating moments of mutual positive emotion expression and then disengaging, a cycle that itself might be regarded as the goal of much early interaction.

Developments in Interactive Smiling Between 2 and 6 Months

As infant levels of smiling-indexed joyful expressions begin to increase around 2 months of age, there is a related increase in maternal positive expressions (Lavelli & Fogel, 2002). Infants and mothers appear to become more responsive to one another and smiling interactions become faster-paced. For example, infant-mother smile turn-taking (in which partners alternate initiating and terminating their smiles) increases with age (Messinger et al., 2010). Nevertheless, individual infants exhibit stable levels of smiling in face-to-face interactions between 2 and 6 months (Malatesta et al., 1989). Moreover, the timing of dyadic smiling states (the overall distribution, as well as the mean and variance, of periods of mother and infant smiling and non-smiling) over a given interaction became more similar with age (Messinger et al., 2010). In fact, infants appear to become accustomed to specific levels of positive responsivity in their partners such that 2-month-olds smile less at a stranger who is either less or more responsive to the infant's smiles than the infant's mother (Bigelow & Rochat, 2006).

Temporal patterning of smiles Infant patterns of joyful expressivity develop together with changes in the patterning of infant attention to the parent's face. Although infants spend less time gazing at their mothers' faces between 2 and 6 months of age, they become more likely to smile when they are gazing at the mother's face (Kaye & Fogel, 1980). As infant smiles become more likely to occur while gazing at the mother's face, the temporal patterning of infant smiles and gazes at mother's face changes (Yale et al., 2003). Three-month-olds tend to begin and end smiles within a gaze at the parent's face so that early joyful expressions are dependent on visual engagement with the parent. Six-month-olds also begin smiling while gazing at the parent's face; however, they then tend to gaze away, perhaps to regulate joyful arousal, and then end the smile. In fact, during peekaboo, 5-month-old infants tend to avert their gaze from the mother's face more often and for longer periods of time during more intense and longer lasting smiles (Stifter & Moyer, 1991). This suggests that these stronger and longer lasting smiles involve intense positive arousal that the infants regulate by gazing away from the interaction. Thus, by 6 months of age, infants are able to utilize intensely joyful smiles in order to participate in highly arousing social exchanges. At the same time, they become increasingly capable of exercising control over the direction in which they smile allowing for infants to become more effective in regulating their own involvement in interchanges that lead to the experience of positive emotion.

Coy smiles Infants may also engage in "coy smiles," in which they avert their gaze and/or turn their head immediately before or at the apex of the smile in order to regulate their emotional response. Naive observers perceive these coy smiles as communicating shyness in the infant (Draghi-Lorenz, Reddy, & Morris, 2005; Reddy, 2000). Colonnesi, Bögels, de Vente, & Majdandžić (2012) had 4-month-olds interact sequentially with a stranger and with each parent either with or without access to a mirror showing the infant their own face. Approximately 70% of infants engaged in coy smiles and were more likely to do so when they could see their own image during the interaction than when they could not. Infants were also more likely to produce coy smiles in interactions with strangers than when they interacted with their parents, which lends support to the theory that coy smiles may serve a tension-release function that allows infants to simultaneously engage with novel stimuli and regulate their emotional response. These patterns of looking at and away from the interactive partner form the context for the development of smiling in face-to-face interactions.

The Development of Different Types of Smiling

Although the broader category of infant smiling increases between 2 and 6 months during face-to-face interaction, different types of smiling show different developmental trajectories (Mendes & Seidl-de-Moura, 2014; Messinger et al., 2001). Between 1 and 5 months, Mendes and Seidl-de-Moura (2014) indicate an increasing number of associations between specific types of smiles and specific mother behaviors during naturalistic mother-infant interactions at home. For example, 5-month-olds respond to mothers' smiles and vocalizations with simple smiles, open-mouth smiles, and combined open-mouth Duchenne smiles (Mendes & Seidl-de-Moura, 2014). However, the relative likelihood of specific types of smiles occurring in specific contexts varies (Messinger et al., 2001). Simple smiles that do not involve eye constriction or mouth opening increase in all interactive periods, irrespective of whether the mother is smiling or the infant is gazing at the mother (see Fig. 4). By contrast, the more joyful open-mouth Duchenne showed a developmentally specific rise between 2 and 6 months. Infants' open-mouth Duchenne smiling increases only when infants are gazing at their smiling mothers. These especially joyful smiles decline in periods when infants are gazing away from the mother's face and mothers are not smiling. That is, highly joyful smiles become increasingly associated with periods of interaction

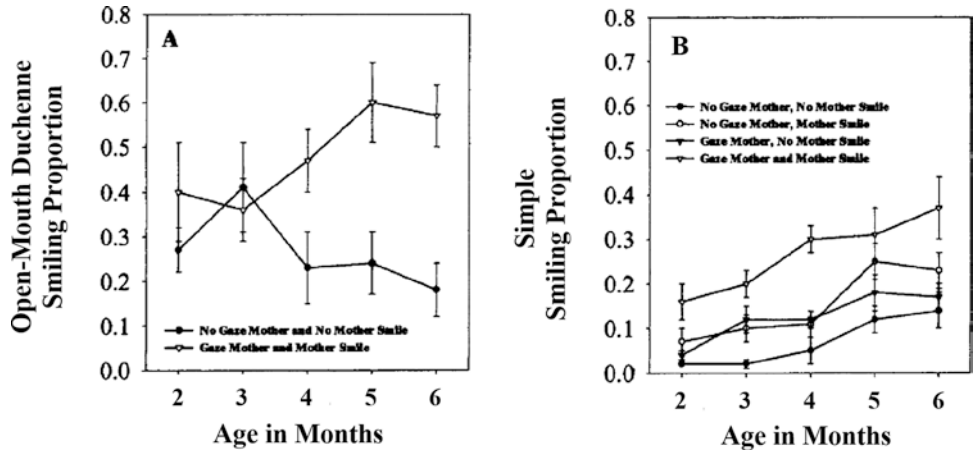

Fig. 4 (**a**) Open-mouth Duchenne smiling increases when infants are gazing at their mothers' faces while their mothers are smiling. It decreases when infants are not gazing at their mothers while their mothers are not smiling. (**b**) By contrast, simple smiling with neither characteristic tends to increase irrespective of where the infant is gazing and whether or not the mother is smiling. (Messinger et al. (2001). Publisher APA, reprinted with permission)

that are more likely to elicit positive engagement. The increase in infants' apparent propensity to engage their smiling mothers with open-mouth Duchenne smiling speaks to their emerging agency in creating these intensely joyful interchanges. Between 2 and 6 months, infants become more active participants in interactive smiling, becoming more likely to initiate smiles at the parent even when the parent is not smiling.

Smiling Between 6 and 18 Months: The Development of Referential Smiling

Through 6 months, infant expressions of positive emotion during face-to-face interactions represent nonreflective communications of their immediate experience (Kaye & Fogel, 1980). After 6 months of age, infants become increasingly likely to use smiling to intentionally communicate positive affect. Beginning with a discussion of mastery smiling, we review the development of expressions of happiness and joy between 6 and 18 months and discuss how these expressions are increasingly integrated into patterns of intentional communication and pretense play.

Happiness and mastery Cognitive differentiation theory holds that success at a challenging task produces happiness. This does not appear to be the case among older children (Harter, Shultz, & Blum, 1971). Between 9 and 11 months, however, infants are more likely to smile and laugh when engaging in newly acquired competencies such as pulling to stand than when involved in tasks which are less difficult such as pulling to sit (Mayes & Zigler, 2006) (but see Yarrow, Morgan, Jennings, Harmon, & Gaiter, 1982). For infants who walk early (before a year), the transition is associated with an increase in expressions of happiness such as smiling (Campos et al., 2000). Mischievous happiness may develop around this age as new walkers smile toward the parent from a distance to ascertain the strictness of parental prohibitions. Such patterns of toddler actions would reflect a developing awareness of another intentions (secondary intersubjectivity), the focus of the next section.

Happiness in referential communication Between 6 and 12 months, infant smiles increasingly occur during coordinated joint engagement when infants actively shift attention between a social partner and toy (Adamson & Bakeman, 1985; Striano & Bertin, 2005). When

gesturing to and looking at an adult examiner to communicate about objects and events, infant smiles enhance the communicative meaning of these joint attention gestures. Infants are more likely to smile during gestural sequences which show or share an object than they are to smile during sequences that request an object (Kasari, Sigman, Mundy, & Yirmiya, 1990; Messinger & Fogel, 1998). More broadly, infants begin to communicate happiness and joy while referencing objects in the environment. In what is known as triadic communication, they communicate happiness *about* objects and events outside of the infant-partner dyad. These bouts of triadic communication tend to increase between 5 and 9 months of age (Striano & Bertin, 2005). Infants between 5 and 9 months of age are more likely to only gaze between a partner and toy than they are to add a smile to this interchange, suggesting that the smile adds to the complexity of the triadic communicative communication.

Anticipatory (referential) smiling A more specific form of triadic communication, anticipatory smiling, begins to increase in frequency between 8 and 12 months. Anticipatory smiling occurs when an infant attends to and smiles at an interesting object or event and continues to smile as they shift their attention to their social partner (see Fig. 5) (Venezia, Messinger, Thorp, & Mundy, 2004). Anticipatory smiles are typically elicited during periods of joint engagement where an experimenter activates and places a windup toy on a table, and the temporal sequence of infants' smiling and gazing between the toy and the experimenter is recorded (Mundy, Hogan, & Doehring, 1996; Seibert, Hogan, & Mundy, 1982). Under these conditions, infants gaze at the interesting object, smile at the object, and subsequently turn to and smile at the experimenter to communicate something like, "that was funny, wasn't it?" The likelihood that infants engage in anticipatory smiling is linked to the development of more general capabilities, including their ability to comprehend means-end relationships and their ability to communicate intentionally with others (Jones & Hong, 2001). This suggests that anticipatory smiling indexes infants' emerging ability to understand that their experiences of pre-existing positive affect can be shared with another (Venezia et al., 2004). The real-time process of smiling and then referencing an object to a social partner demonstrates the mechanism by which positive emotion may motivate the development of early triadic communications (Adamson & Bakeman, 1985; Fogel & Thelen, 1987; Jones & Hong, 2005; Venezia et al., 2004).

Happiness and pretense Between 5 and 18 months, infants become more likely to express happiness and joy in response to pretense and incongruous events. By 5 months of age, infants smile and laugh more in response to an assistant enacting an absurd action (e.g., poking a clown nose while saying "beep") than an ordinary action (e.g., playing with a ball), even when parents remained neutral (Mireault et al., 2018). Additionally, between 5 and 7 months of age, the

Fig. 5 Anticipatory smile. A 12-month-old infant gazes at an object (left), smiles at the object (middle), and gazes at the experimenter while continuing to smile (right)

duration of infants' smiles and laughs is longer, and infants are faster to initiate smiles and laughs when their parents provide them with positive affective cues (Mireault et al., 2015). At 18 months, similar patterns are evident when mothers engage in pretend activities (Lillard et al., 2007; Nishida & Lillard, 2007). Mothers smiled more when pretending versus really eating a snack with their 18-month-olds. The 18-month-olds also exhibited more happiness and participated in the pretend activities when mothers smiled more. These findings suggest that incongruity elicits joyfulness early in life, with the parent's positive expressions serving as a social signal which enhance the infant's enjoyment of those events.

Expressions of Happiness and Joy in Older Children

Overview Between 1 and 2 years of age, toddler's smiling and laughter become increasingly tied to pretense play with parents. Through 4 years, children use different types of smiling in response to social success experiences and foster emerging patterns of social affiliation. Between 6 and 8 years of age, smiles decrease when alone but remain a powerful social signal.

Positive expressiveness in peer play By 2 years of age, peer play becomes an increasingly important venue for expressions of positive emotion. Three- to 5-year-olds indicate that they prefer smiling versus non-smiling potential playmates (Schultz, Ambike, Buckingham-Howes, & Cheah, 2008). Moreover, between 2 and 5 years of age, observational research in preschools indicates that different types of smiling have different social functions (Cheyne, 1976; Sarra & Otta, 2001). Closed-mouth smiling, akin to simple smiling, which involves neither mouth opening nor eye constriction, tends to occur when children are alone (Cheyne, 1976), and it is *negatively* associated with teacher ratings of happiness (Sarra & Otta, 2001). Closed-mouth smiles are distinct both from upper smiles in which the upper teeth are visible (which appear to index Duchenne smiling) and from broad smiles in which both sets of teeth are visible, which are likely to include open-mouth smiles with Duchenne eye constriction (Sarra & Otta, 2001). Broad smiles covary with laughter, and the frequencies of upper smiles, broad smiles, and laughter were positively associated with rated happiness (Sarra & Otta, 2001). Moreover, open-mouth smiles, with and without Duchenne eye constriction, appear to reflect increasing levels of gender-specific social activity between 2 and 4 years of age. Over this age range, boys increasingly direct these smiles to their male peers, and girls increasingly direct these smiles to their female peers (Cheyne, 1976).

Positive expressiveness in games with an adult experimenter Experimental research suggests that open-mouth and Duchenne smiles are associated with success experiences and sociality in early childhood. Between 3 and 6 years of age, the components of Duchenne smiles (smiling and eye constriction) are linked to social proximity, occurring more frequently when a child played a game next to an adult experimenter than when the experimenter was seated at another table (Schneider & Josephs, 1991). Smiling of any type was more frequent in response to successful trials in which children produced a rewarding light and sound display than failure trials (when they were shown the same display) at all ages. Around 4 years of age, children produced stronger smiles in a game involving success and failure experiences than in a game that did not, and by 5 years, Duchenne smiles also exhibited this specificity (Schneider & Uzner, 1992). The results suggest an increasingly specific use of Duchenne smiles in the context of social success experiences. Likewise, an examination of 2–6-year-old perceptions of adult Duchenne smiles in photographs suggests increasingly sophisticated awareness of this joyful expression (Song, Over, & Carpenter, 2016). Three-year-olds, but not 2-year-olds, spent more time gazing at a Duchenne than a paired non-Duchenne smile. Four-year-olds, but not 3-year-olds, expressed a

verbal preference for the Duchenne smiles when asked to identify "real smiles." Moreover, 4- and 5-year-olds expected individuals with Duchenne smiles to be nicer and more generous.

Covert joy Holodynski (2004) argues that at younger ages, the expression of joy is both emotional and social, a marker for oneself and for others. At older ages, the expression of joy is miniaturized when alone but continues to be employed socially to communicate enjoyment to another. Specifically, Holodynski (2004) examined expressions of strong positive emotion—receiving candy from a previously recalcitrant vending machine—between 6 and 8 years of age. Younger children exhibited similar levels of joyful expressions with and without an experimenter present. However, older children exhibited weaker joyful expressions when alone than when in the social condition, although reported levels of joy did not decline. In a finding conceptually in concert with Holodynski's, Kromm et al. found that by 6 (but not 4) years of age, children were adept at using smiles to convince observers that they are pleased with a disappointing gift (Kromm, Färber, & Holodynski, 2014). Taken together, these results suggest that between 6 and 8 years of age is important to children's development of the ability to exert volitional control over their emotional expressions of happiness.

Joyful Expressivity and Developmental Associations with Social Competence and Life Outcomes

The expression of positive emotion may elicit reciprocal interactions with one's social partners, providing engaging experiences which promote social competence. This section reviews evidence for associations between early joyful expressivity and indices of social competences such as rule-following, (low levels of) inhibition, and attachment security. Proceeding developmentally, it is then concerned with evidence that the intensity of joyful expressions in iconic self-presentations (e.g., yearbook photographs) is associated with self-reports of life satisfaction.

Happiness, Joy, and Social Competence in Early Childhood

Social joy Infant's positive smiling reactions to more social elicitors (e.g., peekaboo) and to less social elicitors (e.g., pop-up toys) have different correlates. Only smiling to more social elicitors is associated with observed positive emotional tone during infant interactions with their parents, and with their parent ratings of day-to-day positive emotion (Aksan & Kochanska, 2004). During early smiling interactions, infants and parents engage in mutual, enjoyable exchanges. Motivated by their own enjoyment, contributing to the parent's joyful expressions may lead infants to experience the joyfulness of others as key to their own happiness. In fact, shared infant-mother positive expressions such as smiles, together with overall maternal responsivity to the infant, are associated with children's internalization of social norms (obeying the rules) as manifested in committed compliance to maternal requests such as cleaning up without reminders (Kochanska, 2002; Kochanska, Forman, & Coy, 1999). In this way, experiences of reciprocal joyful responsivity appear to shape the infant's developing social competence into childhood.

Joy as temperament Positive reactions to novelty in early infancy show associations with reduced behavioral inhibition and reticence at 2 years of age. Using an extreme group design, 4-month-olds' positive emotional responses to standardized auditory (nonsense syllables) and visual (mobiles) stimuli showed moderate stability between 1 and 2 years of age (Fox et al., 2001). Infants who responded to the stimuli with high levels of smiling, positive vocalizations, and motor movement exhibited different developmental trajectories than infants who were nonresponsive or exhibited more negative reactions. The infants who exhibited higher levels of positive emotion expressions were less behavior-

ally inhibited with unfamiliar toys and adults at 14 and 24 months of age; however, 4-month emotional positivity was not associated with inhibition with peers at 4 years. The results indicate that exuberant responses to relatively nonsocial stimuli in early infancy are associated with noninhibited responses through 2 years of age, when other factors—including prior inhibition and daycare experience—become more powerful correlates of peer play behavior.

The predictive validity of interactive smiling Early positive expressivity shows some associations with later attachment security and social competence. Infants who exhibit increases in smiling during face-to-face interaction with the parent between 2 and 8 months tend to exhibit secure attachment with the parent at 2.5 years of age (Malatesta et al., 1989; Malatesta, Grigoryev, Lamb, Albin, & Culver, 1986). Infants who smile when their parent adopts a nonresponsive still-face may be more likely to develop secure attachments than other infants (Mesman et al., 2009). Levels of anticipatory smiling at 9 months toward 1 year of age shows associations with parent reports of social expressivity at 30 months (Parlade et al., 2009). Likewise, Duchenne smiling during and preceding reunions with the mother in the strange situation at 18 months predicted the mothers' ratings of extraversion and openness to experience 2 years later (Abe & Izard, 1999). It appears that positive emotion expression may elicit positive engagement from social partners that fosters security and social competence.

Positive Expressiveness and Positive Life Outcomes in Adulthood

Early joy and later satisfaction There is a dearth of information on associations between early joy and later-life satisfaction. In a long-range longitudinal study, Coffey, Warren, & Gottfried, (2015) found that parent reports of infant happiness and adolescent self-reported happiness—although not associated with one another—were both individual predictors of life satisfaction at age 29. The results suggest that early joy is a significant, though not especially stable, predictor of life satisfaction. There is ample evidence, however, that more intense expressions of joy in photographs are associated with positive life outcomes.

Joyful expressiveness in photos and life satisfaction The relationship between expressions of joy and positive life outcomes has been instantiated by a corpus of studies examining intriguing associations between Duchenne smiling intensity in photographs of young adults and later well-being. In college-aged adults, individual differences in Duchenne smiling intensity in yearbook and Facebook photos are associated with later-life satisfaction. Harker and Keltner (2001) found that women with more intense Duchenne smiles in their college yearbook photos at age 21 scored higher on a self-report measure of well-being at 21, 27, and 52 years of age than women with less intense smiles. In a more recent cohort, students with more intense smiles in their Facebook profile pictures during their first semester of college were more satisfied with their lives at graduation than students with less intense smiles (Seder & Oishi, 2011). Moreover, Hertenstein and colleagues (2009) found that individuals who smiled more intensely in photographs from childhood and early adulthood were less likely to be divorced later in life (but see Harker & Keltner, 2001). In sum, self-presentations of joyful expressiveness in photographs are robustly associated with later positive social and emotional outcomes. These findings suggest links between joyful expressivity and later-life outcomes which may be mediated by actions of the individual and/or the reactions they elicit in their social partners.

Gender, Cultural, and Risk-Based Difference in Happiness and Joy

Overview The development of happiness and joy is contextualized by gender and cultural differences in the expression of these positive emotions. Gender differences in positive emotion

expression (more female smiling) are highest in adolescence but may be constrained to interactions with unfamiliar persons. Cultural differences in positive emotion expression (high levels of Western smiling) begin early in development and are influenced by parental and more general emotional values and perceptions of smiling. Finally, differences in positive emotional expressivity enhance our understanding of blindness, maternal depression, Down syndrome, and autism.

The development of gender differences in positive emotion expression Gender effects in the expression of positive emotion emerge developmentally (Chaplin & Aldao, 2013). In a meta-analytic review of facial, vocal, and bodily expression of positive emotion between infancy and adolescence, girls expressed more indices of positive emotions such as happiness and surprise than boys (Chaplin & Aldao, 2013). Age, however, moderated this small gender difference. Gender differences in positive emotion expression were not evident in infancy or toddlerhood. From middle childhood through adolescence, girls exhibited more positive emotion expressions than boys, a difference characterized by small to medium effect sizes (Chaplin & Aldao, 2013). However, gender differences in the expression of positive emotion do not follow a linear pattern of development throughout the lifespan. Gender differences in smiling are largest for adolescents, with females smiling more than males, and gradually decrease over adulthood (from 18 to 65 years of age) (LaFrance, Hecht, & Paluck, 2003). Taken together, these findings point to a U-shaped pattern of development for gender differences in the expression of positive emotion in which gender differences emerge in middle childhood, steadily increase throughout the adolescent period where they reach their peak, and begin to gradually decrease beginning in young adulthood. Changes in the magnitude of sex differences across development are likely to reflect the differing influence of social norms on emotion expression in males and females.

Context affects gender differences Further evidence in support of the influence of social norms involves contextual moderation of the tendency of females to exhibit more positive emotion expressions than males. From middle childhood on, the tendency of girls to exhibit more positive expressions than boys is evident in the presence of unfamiliar others but not when alone or in the presence of familiar others (e.g., parents or peers) (Chaplin & Aldao, 2013; LaFranc et al., 2003). This finding, which is consistent with other investigations which have shown that women have a propensity to exhibit more positive emotion expressions than men in the face of social tension (LaFrance et al., 2003), suggests that smiling may be a gender-biased index of happiness.

Cross-Cultural Research on the Development of Happiness and Joy

Cross-cultural overview Research on the development of positive emotion is often conducted with Western infants, often from more educated families (Henrich, Heine, & Norenzayan, 2010). This restricted pattern of sampling may limit awareness of similarities and differences in the development of positive emotions across cultures (Sauter et al., 2014). Available data suggest that culture plays an important role in shaping early signals of happiness and joy (Fogel, Toda, & Kawai, 1988; Keller & Otto, 2009). Specifically, parents and caregivers affect positive emotional expression by the ways they play or do not play with their infants (Halberstadt & Lozada, 2011). Kuchner (1989), for example, found that Chinese-American mothers were less encouraging of expression of positive affect than European-American mothers. In a potentially related result, Camras et al. (1998) found that Chinese 11-month-olds exhibited fewer overall smile expressions and fewer Duchenne smile expressions than both their European-American and Japanese counterparts in a baseline procedure with the parent present.

Early differences in positive expressivity In an attempt to systematically classify cross-cultural differences in the development of expressions of happiness and joy, Keller and colleagues (Keller, Borke, Lamm, Lohaus, & Dzeaye Yovsi, 2011; Wörmann, Holodynski, Kärtner, & Keller, 2012, 2014) contrasted a more independent cultural group (middle-class Germans from Munster) with a more interdependent group (Nso farmers in Cameroon). Mutual gazing, which tends to be fertile soil for dyadic smiling, was two to five times higher in the Münster than in the Nso sample between 6 and 12 weeks. Durations of both infant and mother smiles (the latter during periods of mutual gaze) were somewhat higher in the German (Münster) than the Cameroonian group at 6 weeks and diverged increasingly at 8, 10, and 12 weeks. The two groups exhibited a similar divergence in rates of infant and mother smile imitation (responding in kind to increases and decreases in the partner's smiling) in this period, indicating cultural differences in responses to smiling.

Developmental differences in predictors of infant smiling The German and Cameroonian groups also exhibited developmental similarities and differences in the influence of parent smiling on the development of infant positive emotional expression (Wörmann et al., 2014). At 6 weeks, higher levels of maternal smiling during periods of mutual gaze were associated with longer infant smiles in both the German and Cameroonian cultural contexts. At 8 and 12 weeks, maternal imitation of infant smiles was associated with increases in the duration of infant smiles in the German sample, an association not evident in the Cameroonian sample until 12 weeks. The results shed light on cultural differences in the influence of maternal behaviors on infant expressions of joy.

Cross-cultural differences in parental expectations Parental expectations and practices with respect to the expression of happiness and joy are culture-specific (Kärtner, Holodynski, & Wörmann, 2013). More highly educated Western parents value intense expressions of positive affect and appear to structure their interactions to elicit and amplify intense expressions of positive affect, which may be seen as manifestations of autonomous delight. By contrast, cultural groups in subsistence economies tend to value states of quiet contentment, which are perceived to be consonant with harmonious social relationships. The emergence of intense display of mutual affect may be one among multiple potential dyadic attractors. Caregiver responsiveness to infant expressions of positive affect is experience expectant. However, the imitative and amplified expressions of parental positive affect common in Western cultures appear to be experience dependent. Continued investigation of the influence of socialization practices on the expression of happiness and joy could suggests mechanisms for cross-cultural variability in the development of these emotional states.

Cross-cultural perspectives on the meaning of smiles Although smiles are a universal facial expression, the functions of the smile appear to vary systematically across cultures. Smiles can be understood to index positive emotion, to facilitate social cooperation, and to express dominance. Rychlowska and colleagues (2015) found that cross-cultural variation in the meaning of smiles varies with the historical heterogeneity of a society (Rychlowska et al., 2015). Individuals from ethnically heterogeneous societies with a history of migration from diverse source countries differ from individuals in less heterogeneous societies with respect to their understanding of the meaning of smiles. In historically heterogeneous societies, rewarding positive affect and social cooperation are more likely to be endorsed as motivating smiles. In historically less heterogeneous societies, smiles are more likely to be understood as being motivated by negotiation of social hierarchy (communicating or accepting dominance). The results suggest that the role of smiles in communicating happiness and joy, at least among adults, may vary cross-culturally.

Smiling as an Index of Developmental Risk and Disability

Developmental risk factors impact the expression of happiness and joy The amount of smiling differs between infants who are typically developing and those who are at risk for disturbed development due to a variety of risks. Here we review differences in the expression of joy associated with maternal depression, prematurity, blindness, Down syndrome, and autism spectrum. Results suggest that the development of joyful expressiveness is differentially sensitive to these risk factors.

Maternal depression and infant prematurity Infants whose mothers are chronically depressed or display long-lasting depressive symptomatology smile less, especially when interacting with their mothers (Moore, Cohn, & Campbell, 2001). This is likely due to a lack of positive maternal responsivity to the infant's bids for engagement. The less joyful expression from the mother, the less likely the child is to appear happy when interacting with her. Premature infants also display decreased smiling as compared to full-term infants. During peekaboo with an experimenter, premature infants exhibit fewer strong smiles and exhibit fewer strong open-mouth smiles during face-to-face interactions with a parent (Eckerman, Hsu, Molitor, Leung, & Goldstein, 1999; Segal et al., 1995). This may be driven by the difficulty premature infants experience coping with even positive affective arousal, curtailing the intensity of joyful expression in these infants in the first year of life.

Smiling in blind infants and children Blind infants smile when they hear a familiar voice, and social smiling increases from 4 to 12 months, just as it does for sighted infants. However, without visually mediated reciprocal interchange with a social partner, blind infants smile less often and more fleetingly than their seeing peers. Seeing one's partner smile is likely a motivation to sustain the duration of smiles. This lack of mutually reinforcing feedback may also play a role in the decrease in smiling seen in blind children after they reach the age of 2 or 3 years (Fraiberg, 1975; Freedman, 1964; Ganchrow, Steiner, & Daher, 1983; Rogers & Puchalski, 1986; Thompson, 1941; Troster & Brambring, 1992).

Joyful expressiveness and Down syndrome The emergence of shared joy and positive affect between infant and parent appears to develop similarly in infants with and without Down syndrome (trisomy) (Carvajal & Iglesias, 2002). However, the cognitive deficits, psychomotor delays, and difficulties with sensorimotor integration present in children with trisomy contribute to differences in the rate of development and response to changes within the environment (Carvajal & Iglesias, 2002). When interacting with their mothers, 2-month-olds and 5-month-olds with Down syndrome are rated as less lively but not less happy than infants without Down syndrome (Slonims & McConachie, 2006). Infants with Down syndrome, like infants without trisomy, tend to smile when they gaze at their parent's face during play in the first year of life (Carvajal & Iglesias, 2000). Whereas typically developing infants demonstrate more Duchenne open-mouth smiles when interacting with their mothers than when they play with toys, infants with Down syndrome display Duchenne open-mouth smiles more often overall and with less discrimination in context (Carvajal & Iglesias, 2001). In response to the still-face, infants with Down syndrome show less of a decrease in smiling than typically developing infants (Carvajal & Iglesias, 1997). These results combined suggest that infants with Down syndrome experience similar levels of happiness as typically developing children, but their cognitive delays diminish the specificity of environmental influences on their expression of joy.

Happiness and Down syndrome Overall, 99% individuals with Down syndrome report that they are happy with their lives (Skotko, Levine, & Goldstein, 2011), and teachers and parents report

that these children frequently have a cheerful orientation toward others (Carr, 1995; Gibbs & Thorpe, 1983; Gilmore, Campbell & Cuskelly, 2003). In middle childhood, children with Down syndrome smile more frequently than children without trisomy (Fidler et al., 2005). This pattern of smiling social behavior has led to the perception that individuals with Down syndrome are happier than typically developing individuals (Carr, 1995; Fidler, 2006). Cheerful social signals from individuals with Down syndrome appear to index high levels of joy and may also be used as a coping strategy to compensate for cognitive limitations (Carr, 1995; Kasari & Freeman, 2001).

Autism spectrum disorder overview Autism spectrum disorder (ASD) is characterized by social communication impairments which are evident early in development and pervasive over the lifetime. Approximately 20% of children who have an older sibling with autism will themselves develop autism (Messinger et al., 2015). Using a high-risk sibling design, infants at elevated risk for developing ASD are followed through toddlerhood when ASD can be reliably diagnosed. In the first year of life, differences in the expression of joy, particularly in social contexts, begin to differentiate infants who will go on to develop ASD from other infants, but the timing of these differences is not yet clear.

Early joyful expression and autism Ozonoff et al. (2010) found that social smiles to an examiner did not distinguish infants with later ASD from low-risk infants at 6 months, and Rozga et al. (2011) found no difference in the duration of smiling toward the mother throughout the FFSF. However, Lambert-Brown et al. (2015) found differences among 6-month-olds in the frequency of smile onsets to the parent before and after the still-face. Low-risk infants showed a decrease in the frequency of smile onsets after the still-face perturbation, while high-risk infants with later ASD did not (their smile frequency remained low from the initial to the post still-face interaction). Put another way, a break in interaction with the parent did not alter the expression of joy in the 6-month-olds who later developed autism. By 1 year (and through diagnosis at 3 years) it is relatively clear that infants who will go on to develop ASD show fewer social smiles with an examiner than other infants (Ozonoff, et al., 2010; Zwaigenbaum, 2005). When interacting with an examiner during an autism assessment, high-risk 15-month-olds showed fewer social smiles than the low-risk group. Infants from the high-risk group who went on to develop ASD also had fewer nonsocial smiles than the typical controls (Nichols, Ibanez, Foss-Feig, & Stone, 2014). However, Harker, Ibañez, Nguyen, Messinger, and Stone (2016) found that when interacting with their mothers, high-risk infants showed an increased growth in social smiling between 9 and 18 months, but only when controlling for the responsivity and directiveness of the mothers. Overall, these results indicate that between 6 and 12 months, infants developing autism exhibit lower levels of expressed happiness and joy that persist through at least 3 years of age.

Later happiness and autism People with ASD exhibit differences across the lifespan in the expression of happiness and joy. In toddlers and children, lower levels of shared enjoyment contribute to an index of symptom severity on central ASD diagnostic protocol (Hus, Gotham, & Lord, 2014). Although individuals with ASD show impairments in recognizing emotions in others, a meta-analysis of published papers found limited evidence for specific impairment in the recognition of happiness (Uljarevic & Hamilton, 2013). Nevertheless, social impairments can make it difficult for individuals with ASD to understand humor or sarcasm in others. Consequently, in adults with ASD, humor is less likely to be self-reported as a character strength and is less likely to be associated with life satisfaction than in non-ASD adults (Samson & Antonelli, 2013). Adults with autism also report higher emotional valence ratings for images associated with their circumscribed interests and

lower emotional valence ratings for social images than controls (Sasson, Dichter, & Bodfish, 2012). Taken together, these results indicate that happiness in adults with ASD may be less socially based than in other groups.

Limitations and Future Directions

Although we have a detailed understanding of the development of positive emotions in infancy, current understanding of the psychological and social functions of happiness and joy between preschool age and adolescence is more limited. In part, these limitations derive from difficulties in valid, economical measurement of behavior beyond the laboratory. In this vein, recent computational approaches to the measurement and modeling of positive emotion including objective facial expression analysis, mobile neuroimaging technologies such as functional near-infrared spectroscopy, and automated sentiment monitoring of digital communication represent powerful tools for future developmental research.

Current understanding of positive emotion is primarily derived from research conducted in developed societies. Despite the onset of robust research programs, relatively little is known about how happiness and joy develop in other cultural contexts despite strong evidence for the role of context and culture in socializing the development of positive emotion. Moreover contextual pressures influence positive expressiveness as illustrated, for example, by the rise in female smiling in the presence of unfamiliar persons during adolescence. Ascertaining the type of smiling produced in such interactions may aid in detecting positive emotion. To wit, Duchenne smiling is perhaps the most studied behavioral expressions of happiness. However, research incorporating other behavioral markers such as mouth opening, laughter, and body movement—and their synchronization—may prove equally valuable in understanding more aroused positive emotional states such as joy.

Conclusion

Happiness and joy motivate social approach and are frequently seen as elements of a fulfilled life. However, the value placed on states such as joy may differ by culture, as do interpretations of joyful expressions such as smiles. Nevertheless, available evidence indicates that signals of smile and joy are strongly (and perhaps increasingly) linked to social interaction from infancy through the first 8 years of life. The Duchenne smile, perhaps especially when accompanied by mouth opening and laughter, appears to signal happiness and joy throughout the lifespan. Moreover, such joyful expressiveness appears to be linked to positive social competencies in childhood and life satisfaction in adulthood. Finally, joyful expressiveness varies systematically in response to child risk and disability, offering an index of the importance of happiness and joy in both typical and atypical development.

References

Abe, J., & Izard, C. E. (1999). A longitudinal study of emotion expression and personality relations in early development. *Journal of Personality & Social Psychology, 77*, 566–577.

Ackerman, B. P., Abe, J. A. A., & Izard, C. E. (1998). Differential emotions theory and emotional development: Mindful of modularity. In M. F. Mascolo & S. Griffin (Eds.), *What develops in emotional development?* (pp. 85–106). New York, NY: Plenum Press.

Adamson, L. B., & Bakeman, R. (1985). Affect and attention: Infants observed with mothers and peers. *Child Development, 56*, 582–593.

Adamson, L. B., & Frick, J. E. (2003). The still face: A history of a shared experimental paradigm. *Infancy, 4*, 451–473.

Aksan, N., & Kochanska, G. (2004). Heterogeneity of joy in infancy. *Infancy, 6*(1), 79–94.

Anisfeld, E. (1982). The onset of social smiling in preterm and full-term infants from two ethnic backgrounds. *Infant Behavior and Development, 5*, 387–395.

Anisfeld, E., Casper, V., Nozyce, M., & Cunningham, N. (1990). Does infant carrying promote attachment? An experimental study of the effects of increased physical contact on the development of attachment. *Child Development, 61*(5), 1617–1627.

Bard, K. A. (1992). Intentional behavior and intentional communication in young free-ranging orangutans. *Child Development, 63*(5), 1186–1197.

Barrett, K. C. (1993). The development of nonverbal communication of emotion: A functionalist perspective. *Journal of Nonverbal Behavior, 17*(3), 145–169.

Barrett, L. F. (2006). Solving the emotion paradox: Categorization and the experience of emotion. *Personality and Social Psychology Review, 10*, 20–46.

Barrett, L. F., & Wager, T. D. (2006). The structure of emotion: Evidence from neuroimaging studies. *Current Directions in Psychological Science, 15*(2), 79–83.

Beebe, B., & Gerstman, L. (1984). A method of defining "packages" of maternal stimulation and their functional significance for the infant with mother and stranger. *International Journal of Behavioral Development, 7*(4), 423–440.

Bigelow, A. E., & Rochat, P. (2006). Two-month-old infants' sensitivity to social contingency in mother-infant and stranger-infant interaction. *Infancy, 9*, 313–325.

Bowlby, J. (1982). *Attachment* (Vol. 1, 2nd ed.). New York, NY: Basic Books.

Bridges, K. M. B. (1932). Emotional development in early infancy. *Child Development, 3*, 324–341. https://doi.org/10.2307/1125359

Burrows, A., Waller, B., Parr, L., & Bonar, C. (2006). Muscles of facial expression in the chimpanzee (*Pan troglodytes*): Descriptive, comparative and phylogenetic contexts. *Journal of Anatomy, 208*(2), 153–167.

Bigelow, A. E., Power, M. (2016). Effect of Maternal Responsiveness on Young Infants' Social Bidding-LIke Behavior during the Still Face Task. *Infant Child Development, 25*(3), 256–276. https://doi.org/10.1002/icd.1974.

Cacioppo, J. T., Berntson, G. G., Larsen, J. T., Poehlmann, K. M., & Ito, T. A. (2000). The psychophysiology of emotion. In M. Lews & J. M. Haviland-Jones (Eds.), *Hanbook of emotions* (2nd ed., pp. 173–191). New York, NY: Guilford Press.

Campos, J. J., Anderson, D. I., Barbu-Roth, M. A., Hubbard, E. M., Hertenstein, M. J., & Witherington, D. (2000). Travel broadens the mind. *Infancy, 1*(2), 149–219.

Campos, J. J., Mumme, D. L., Kermoian, R., & Campos, R. G. (1994). A functionalist perspective on the nature of emotion. In N. A. Fox (Ed.), *Monographs of the society for research in child development* (Vol. 59, pp. 284–303, (282–283, Serial No. 240)). Chicago, IL: University of Chicago Press.

Camras, L. A. (2000). Surprise! Facial expressions can be coordinative motor structures. In M. D. Lewis & I. Granic (Eds.), *Emotion, development, and self-organization: Dynamic systems approaches to emotional development* (Vol. xiii, pp. 100–124). Cambridge: Cambridge University Press.

Camras, L. A., Oster, H., Campos, J., Campos, R., Ujiie, T., Miyake, K., … Meng, Z. (1998). Production of emotional facial expressions in European American, Japanese, and Chinese infants. *Developmental Psychology, 34*(1), 616–628.

Carvajal, F., & Iglesias, J. (1997). Mother and infant smiling exchanges during face-to-face interaction in infants with and without Down syndrome. *Developmental Psychobiology, 31*(4), 277–286.

Carvajal, F., & Iglesias, J. (2000). Looking behavior and smiling in Down syndrome infants. *Journal of Nonverbal Behavior, 24*(3), 225–236.

Carvajal, F., & Iglesias, J. (2001). The Duchenne smile with open mouth in infants with Down syndrome. *Infant Behavior and Development, 24*(3), 341–346.

Carvajal, F., & Iglesias, J. (2002). Face-to-face emotion interaction studies in Down syndrome infants. *International Journal of Behavioral Development, 26*(2), 104–112.

Chaplin, T. M., & Aldao, A. (2013). Gender differences in emotion expression in children: A meta-analytic review. *Psychological Bulletin, 139*(4), 735–765. https://doi.org/10.1037/a0030737

Cheyne, J. A. (1976). Development of forms and functions of smiling in preschoolers. *Child Development, 47*(3), 820–823. https://doi.org/10.2307/1128200

Chow, S., Haltigan, J. D., & Messinger, D. S. (2010). Dynamic infant-parent affect coupling during the face-to-face/still-face. *Emotion, 10*, 101–114.

Coffey, J. K., Warren, M. T., & Gottfried, A. W. (2015). Does infant happiness forecast adult life satisfaction? Examining subjective well-being in the first quarter century of life. *Journal of Happiness Studies, 16*(6), 1401–1421. https://doi.org/10.1007/s10902-014-9556-x

Cohn, J., & Tronick, E. (1987). Mother-infant face-to-face interaction: The sequence of dyadic states at 3, 6, and 9 months. *Developmental Psychology, 23*(1), 68–77.

Colonnesi, C., Bögels, S. M., de Vente, W., & Majdandžić, M. (2012). What coy smiles say about positive shyness in early infancy. *Infancy*. https://doi.org/10.1111/j.1532-7078.2012.00117.x

Carr, J. H. (1995). Down's syndrome: Children growing up: Cambridge University Press.

Darwin, C. (1872/1998). *The expression of the emotions in man and animals* (3rd ed.). New York, NY: Oxford University.

Davila-Ross, M., Jesus, G., Osborne, J., & Bard, K. A. (2015). Chimpanzees (*Pan troglodytes*) produce the same types of 'laugh faces' when they emit laughter and when they are silent. *PLoS One, 10*(6), e0127337. https://doi.org/10.1371/journal.pone.0127337

Dickson, K. L., Walker, H., & Fogel, A. (1997). The relationship between smile-type and play-type during parent-infant play. *Developmental Psychology, 33*(6), 925–933.

Dondi, M., Messinger, D., Colle, M., Tabasso, A., Simion, F., Barba, B. D., & Fogel, A. (2007). A new perspective on neonatal smiling: Differences between the judgments of expert coders and naive observers. *Infancy, 12*(3), 235–255. https://doi.org/10.1080/15250000701518511

Draghi-Lorenz, R., Reddy, V., & Morris, P. (2005). Young infants can be perceived as shy, coy, bashful, embarrassed. *Infant and Child Development, 14*(1), 63–83.

Duchenne, G. B. (1990/1862). *The mechanism of human facial expression* (trans: Cuthbertson, R. A.). New York, NY: Cambridge University Press.

Eckerman, C. O., Hsu, H.-C., Molitor, A., Leung, E. H. L., & Goldstein, R. F. (1999). Infant arousal in an en-face exchange with a new partner: Effects of prematurity and perinatal biological risk. *Developmental Psychology, 35*(1), 282–293.

Ekas, N. V., Haltigan, J. D., & Messinger, D. S. (2013). The dynamic still-face effect: Do infants decrease bidding over time when parents are not responsive? *Developmental Psychology, 49*(6), 1027–1035. https://doi.org/10.1037/a0029330

Ekman, P., Davidson, R. J., & Friesen, W. (1990). The Duchenne smile: Emotional expression and brain physiology: II. *Journal of Personality and Social Psychology, 58*(2), 343–353.

Elliot, H. C. (1969). *Textbook of neuroanatomy* (2nd ed.). Philadelphia, PA: J. B. Lippincott.

Emde, R. N., Campos, J., Reich, J., & Gaensbauer, T. J. (1978). Infant smiling at five and nine months: Analysis of heart rate and movement. *Infant Behavior and Development, 1*, 26–35.

Feldman, R. (2003). Infant-mother and infant-father synchrony: The coregulation of positive arousal. *Infant Mental Health Journal, 24*(1), 1–23.

Feldman, R., & Greenbaum, C. W. (1997). Affect regulation and synchrony in mother-infant play as precursors to the development of symbolic competence. *Infant Mental Health Journal, 18*(1), 4–23.

Feldman, R., Greenbaum, C. W., & Yirmiya, N. (1999). Mother-infant affect synchrony as an antecedent of the emergence of self-control. *Developmental Psychology, 35*(1), 223–231.

Feldman, R., Greenbaum, C. W., Yirmiya, N., & Mayes, L. C. (1996). Relations between cyclicity and regulation in mother-infant interaction at 3 and 9 months and cognition at 2 years. *Journal of Applied Developmental Psychology, 17*(3), 347–365. http://www.sciencedirect.com/science/article/pii/S0193397396900313

Feldman, R., Singer, M., & Zagoory, O. (2010). Touch attenuates infants' physiological reactivity to stress. *Developmental Science, 13*(2), 271–278. https://doi.org/10.1111/j.1467-7687.2009.00890.x

Fogel, A. (1988). Cyclicity and stability in mother-infant face-to-face interaction: A comment on Cohn and Tronick. *Developmental Psychology, 24*(3), 393–395.

Fogel, A. (1993). *Developing through relationships: Communication, self, and culture in early infancy*. London, UK: Harvester-Wheatsheaf.

Fogel, A., Hsu, H.-C., Shapiro, A. F., Nelson-Goens, G. C., & Secrist, C. (2006). Effects of normal and perturbed social play on the duration and amplitude of different types of infant smiles. *Developmental Psychology, 42*, 459–473.

Fogel, A., Nwokah, E., Dedo, J. Y., Messinger, D., Dickson, K. L., Matusov, E., & Holt, S. A. (1992). Social process theory of emotion: A dynamic systems approach. *Social Development, 1*(2), 122–142.

Fogel, A., & Thelen, E. (1987). Development of early expressive and communicative action: Reinterpreting the evidence from a dynamic systems perspective. *Developmental Psychology, 23*, 747–761.

Fogel, A., Toda, S., & Kawai, M. (1988). Mother-infant face-to-face interaction in Japan and the United States: A laboratory comparison using 3-month-old infants. *Developmental Psychology, 24*(3), 398–406. https://doi.org/10.1037/0012-1649.24.3.398

Fox, N., & Davidson, R. J. (1988). Patterns of brain electrical activity during facial signs of emotion in 10 month old infants. *Developmental Psychology, 24*(2), 230–236.

Fox, N. A., Henderson, H. A., Rubin, K. H., Calkins, S. D., & Schmidt, L. A. (2001). Continuity and discontinuity of behavioral inhibition and exuberance: Psychophysiological and behavioral influences across the first four years of life. *Child Development, 72*(1), 1–21.

Fraiberg, S. (1975). The development of human attachments in infants blind from birth. *Merrill-Palmer Quarterly, 21*(4), 315–334.

Franklin, B., Oller, D. K., Ramsdell, H., & Jhang, Y. S. (2011). *Affect identification in early infant vocalizations*. Paper presented at the American Speech-Language-Hearing Association, San Diego, CA.

Freedman, D. G. (1964). Smiling in blind infants and the issue of innate vs. acquired. *Journal of Child Psychology & Psychiatry & Allied Disciplines, 5*(3–4), 171–184.

Fidler, D. J. (2006). The emergence of a syndrome-specific personality profile in young children with Down syndrome. Down syndrome: Neurobehavioural specificity, 139–152.

Fidler, D. J., Hepburn, S. L., Mankin, G., Rogers, S. J. (2005). Praxis skills in young children with Down syndrome, other developmental disabilities, and typically developing children. *American Journal of Occupational Therapy, 59*(2), 129–138.

Ganchrow, J. R., Steiner, J. E., & Daher, M. (1983). Neonatal facial expressions in response to different qualities and intensities of gustatory stimuli. *Infant Behavior & Development, 6*(2), 189–200.

Goldsmith, H. H., Buss, K. A., & Lemery, K. S. (1997). Toddler and childhood temperament: Expanded content, stronger genetic evidence, new evidence for the importance of environment. *Developmental Psychology, 33*(6), 891–905.

Goldsmith, H. H., Lemery, K. S., Buss, K. A., & Campos, J. J. (1999). Genetic analyses of focal aspects of infant temperament. *Developmental Psychology, 35*(4), 972–985.

Goldsmith, H. H., & Rothbart, M. K. (1999). *The laboratory temperament assessment battery (Locomotor Version, Edition 3.1)*. Madison, WI: University of Wisconsin-Madison.

Gibbs, M., Thorpe, J. (1983). Personality stereotype of noninstitutionalized Down syndrome children. American Journal of Mental Deficiency.

Gilmore, L., Campbell, J., & Cuskelly, M. (2003). Developmental expectations, personality stereotypes, and attitudes towards inclusive education: Community and teacher views of Down syndrome. *International Journal of Disability, Development and Education, 50*(1), 65–76.

Halberstadt, A. G., & Lozada, F. T. (2011). Emotion development in infancy through the lens of culture. *Emotion Review, 3*(2), 158–168. https://doi.org/10.1177/1754073910387946

Hane, A. A., Fox, N. A., Henderson, H. A., & Marshall, P. J. (2008). Behavioral reactivity and approach-withdrawal bias in infancy. *Developmental Psychology, 44*(5), 1491–1496. https://doi.org/10.1037/a0012855

Harker, C. M., Ibañez, L. V., Nguyen, T. P., Messinger, D. S., & Stone, W. L. (2016). The effect of parenting style on social smiling in infants at high and low risk for ASD. *Journal of Autism and Developmental Disorders, 46*(7), 2399–2407. https://doi.org/10.1007/s10803-016-2772-y

Harmon, R. J., & Emde, R. N. (1972). Endogenous and exogenous smiling systems in early infancy. *Journal of the American Academy of Child Psychiatry, 11*, 77–100.

Harter, S., Shultz, T. R., & Blum, B. (1971). Smiling in children as a function of their sense of mastery. *Journal of Experimental Child Psychology, 12*(3), 396–404.

Harker, L., Keltner, D. (2001). Expressions of positive emotion in women's college yearbook pictures and their relationship to personality and life outcomes across adulthood. *Journal of Personality and Social Psychology, 80*(1), 112–124.

Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences, 33*, 61–135.

Hertenstein, M. J., Holmes, R., McCullough, M., & Keltner, D. (2009). The communication of emotion via touch. *Emotion, 9*(4), 566–573. https://doi.org/10.1037/a0016108.

Holodynski, M. (2004). The miniaturization of expression in the development of emotional self-regulation. *Developmental Psychology, 40*(1), 16–28.

Hsu, H.-C., Fogel, A., & Messinger, D. S. (2001). Infant non-distress vocalization during mother-infant face-to-face interaction: Factors associated with quantitative and qualitative differences. *Infant Behavior & Development, 24*(1), 107–128.

Hus, V., Gotham, K., & Lord, C. (2014). Standardizing ADOS domain scores: Separating severity of social affect and restricted and repetitive behaviors. *Journal of Autism and Developmental Disorders, 44*(10), 2400–2412. https://doi.org/10.1007/s10803-012-1719-1

Izard, C. E., & Ackerman, B. P. (2000). Motivational, organizational, and regulatory functions of discrete emotions. In M. Lewis & J. M. Haviland-Jones (Eds.), *Handbook of emotions* (2nd ed., pp. 253–264). New York, NY: Guilford Press.

Jones, S. S., & Hong, H.-W. (2001). Onset of voluntary communication: Smiling looks to mother. *Infancy, 2*(3), 353–370.

Jones, S. S., & Hong, H.-W. (2005). How some infant smiles get made. *Infant Behavior & Development, 28*(2), 194–205.

Kahana-Kalman, R., & Walker-Andrews, A. S. (2001). The role of person familiarity in young infants' perception of emotional expressions. *Child Development, 72*(2), 352–369.

Kärtner, J., Holodynski, M., & Wörmann, V. (2013). Parental ethnotheories, social practice and the culture-specific development of social smiling in infants. *Mind, Culture, and Activity, 20*(1), 79–95. https://doi.org/10.1080/10749039.2012.742112

Kasari, C., Sigman, M., Mundy, P., & Yirmiya, N. (1990). Affective sharing in the context of joint attention interactions of normal, autistic, and mentally retarded children. *Journal of Autism and Developmental Disorders, 20*(1), 87–100.

Kasari, C., Freeman, S. F. (2001). Task-related social behavior in children with Down syndrome. *American Journal on Mental Retardation, 106*(3), 253–264.

Kaye, K., & Fogel, A. (1980). The temporal structure of face-to-face communication between mothers and infants. *Developmental Psychology, 16*(5), 454–464.

Keller, H., Borke, J., Lamm, B., Lohaus, A., & Dzeaye Yovsi, R. (2011). Developing patterns of parenting in two cultural communities. *International Journal of Behavioral Development, 35*(3), 233–245.

Keller, H., & Otto, H. (2009). The cultural socialization of emotion regulation during infancy. *Journal of Cross-Cultural Psychology, 40*(6), 996–1011. https://doi.org/10.1177/0022022109348576

Kochanska, G. (2002). Mutually responsive orientation between mothers and their young children: A context for the early development of conscience. *Current Directions in Psychological Science, 11*(6), 191–195.

Kochanska, G., Forman, D. R., & Coy, K. C. (1999). Implications of the mother-child relationship in infancy socialization in the second year of life. *Infant Behavior & Development, 22*(2), 249–265.

Kromm, H., Färber, M., & Holodynski, M. (2014). Felt or false smiles? Volitional regulation of emotional expression in 4-, 6-, and 8-year-old children. *Child Development*, n/a–n/a. https://doi.org/10.1111/cdev.12315

Kuchner, J. F. (1989). Chinese-American and European-American Mothers and Infants: Cultural Influences in the First Three Months of Life.

LaFrance, M., Hecht, M. A., Paluck, E. L. (2003). The contingent smile: a meta-analysis of sex differences in smiling. *Psychol Bull, 129*(2), 305–334.

Lambert-Brown, B. L., McDonald, N. M., Mattson, W. I., Martin, K. B., Ibañez, L. V., Stone, W. L., & Messinger, D. S. (2015). Positive emotional engagement and autism risk. *Developmental Psychology, 51*(6), 848–855. https://doi.org/10.1037/a0039182

Landau, R. (1989). Affect and attachment: Kissing, hugging, and patting as attachment behaviors. *Infant*

Mental Health Journal, 10(1), 59–69. https://doi.org/10.1002/1097-0355(198921)10:1<59::aid-imhj2280100106>3.0.co;2-6

Lavelli, M., & Fogel, A. (2002). Developmental changes in mother-infant face-to-face communication: Birth to 3 months. *Developmental Psychology, 38*(2), 288–305.

Lavelli, M., & Fogel, A. (2005). Developmental changes in the relationship between the infant's attention and emotion during early face-to-face communication: The 2-month transition. *Developmental Psychology, 41*(1), 265–280.

Leppänen, J. M., Richmond, J., Vogel-Farley, V. K., Moulson, M. C., & Nelson, C. A. (2009). Categorical representation of facial expressions in the infant brain. *Infancy, 14*(3), 346–362. https://doi.org/10.1080/15250000902839393

Lewis, M. (2000). The emergence of human emotions. In M. Lewis & J. M. Haviland-Jones (Eds.), *Handbook of emotions* (2nd ed., pp. 265–292). New York, NY: Guilford Press.

Lillard, A., Nishida, T., Massaro, D., Vaish, A., Ma, L., & McRoberts, G. (2007). Signs of pretense across age and scenario. *Infancy, 11*(1), 1–30. https://doi.org/10.1080/15250000709336868

Lindquist, K. A., Satpute, A. B., Wager, T. D., Weber, J., & Barrett, L. F. (2016). The brain basis of positive and negative affect: Evidence from a meta-analysis of the human neuroimaging literature. *Cerebral Cortex, 26*(5), 1910–1922. https://doi.org/10.1093/cercor/bhv001

Malatesta, C. Z., Culver, C., Tesman, J. R., & Shepard, B. (1989). Engaging the commentaries: When is an infant affective expression an emotion? *Monographs of the Society for Research in Child Development, 54*(1–2, Serial No. 219), 125–136.

Malatesta, C. Z., Grigoryev, P., Lamb, C., Albin, M., & Culver, C. (1986). Emotion socialization and expressive development in preterm and full-term infants. *Child Development, 57*(2), 316–330.

Malatesta, C. Z., & Haviland, J. M. (1982). Learning display rules: The socialization of emotion expression in infancy. *Child Development, 53*(4), 991–1003. https://doi.org/10.2307/1129139

Mattson, W. I., Cohn, J. F., Mahoor, M. H., Gangi, D. N., & Messinger, D. S. (2013). Darwin's Duchenne: Eye constriction during infant joy and distress. *PLoS One, 8*(11), e80161.

Mattson, W. I., Ekas, N. V., Lambert, B., Tronick, E., Lester, B. M., & Messinger, D. S. (2013). Emotional expression and heart rate in high-risk infants during the face-to-face/still-face. *Infant Behavior & Development, 36*(4), 776–785. https://doi.org/10.1016/j.infbeh.2012.11.009

Mayes, L. C., & Zigler, E. (2006). An observational study of the affective concomitants of mastery in infants. *Journal of Child Psychology and Psychiatry, 33*(4), 659–667. https://doi.org/10.1111/j.1469-7610.1992.tb00903.x

Mendes, D. M. L. F., & Seidl-de-Moura, M. L. (2014). Different kinds of infants' smiles in the first six months and contingency to maternal affective behavior. *The Spanish Journal of Psychology, 17*, null–null. https://doi.org/10.1017/sjp.2014.86

Mesman, J., van IJzendoorn, M. H., & Bakermans-Kranenburg, M. J. (2009). The many faces of the Still-Face Paradigm: A review and meta-analysis. *Developmental Review, 29*(2), 120–162.

Messinger, D. (2002). Positive and negative: Infant facial expressions and emotions. *Current Directions in Psychological Science, 11*(1), 1–6.

Messinger, D., Dondi, M., Nelson-Goens, G. C., Beghi, A., Fogel, A., & Simion, F. (2002). How sleeping neonates smile. *Developmental Science, 5*(1), 48–54.

Messinger, D., & Fogel, A. (1998). Give and take: The development of conventional infant gestures. *Merrill-Palmer Quarterly, 44*(4), 566–590.

Messinger, D., Fogel, A., & Dickson, K. (1999). What's in a smile? *Developmental Psychology, 35*(3), 701–708.

Messinger, D., Fogel, A., & Dickson, K. (2001). All smiles are positive, but some smiles are more positive than others. *Developmental Psychology, 37*(5), 642–653.

Messinger, D., Fogel, A., & Dickson, K. L. (1997). A dynamic systems approach to infant facial action. In J. A. Russell & F. M. Dols (Eds.), *The psychology of facial expression* (pp. 205–226). New York, NY: Cambridge University Press.

Messinger, D., Ruvolo, P., Ekas, N., & Fogel, A. (2010). Applying machine learning to infant interaction: The development is in the details. *Neural Networks, 23*(10), 1004–1016.

Messinger, D. S., Mahoor, M. H., Chow, S.-M., & Cohn, J. F. (2009). Automated measurement of facial expression in infant–mother interaction: A pilot study. *Infancy, 14*(3), 285–305. https://doi.org/10.1080/15250000902839963

Messinger, D. S., Mattson, W. I., Mahoor, M. H., & Cohn, J. F. (2012). The eyes have it: Making positive expressions more positive and negative expressions more negative. *Emotion, 12*(3), 430–436.

Messinger, D. S., Young, G. S., Webb, S. J., Ozonoff, S., Bryson, S. E., Carter, A., … Zwaigenbaum, L. (2015). Early sex differences are not autism-specific: A Baby Siblings Research Consortium (BSRC) study. *Molecular Autism, 6*, 32. https://doi.org/10.1186/s13229-015-0027-y

Mireault, G. C., Crockenberg, S. C., Heilman, K., Sparrow, J. E., Cousineau, K., & Rainville, B. (2018). Social, cognitive, and physiological aspects of humour perception from 4 to 8 months: Two longitudinal studies. *The British Journal of Developmental Psychology, 36*(1), 98–109. https://doi.org/10.1111/bjdp.12216

Mireault, G. C., Crockenberg, S. C., Sparrow, J. E., Cousineau, K., Pettinato, C., & Woodard, K. (2015). Laughing matters: Infant humor in the context of parental affect. *Journal of Experimental Child Psychology, 136*, 30–41. https://doi.org/10.1016/j.jecp.2015.03.012

Mizuno, Y., Takeshita, H., & Matsuzawa, T. (2006). Behavior of infant chimpanzees during the night in the

first 4 months of life: Smiling and suckling in relation to behavioral state. *Infancy, 9*(2), 221–240.

Montague, D. P. F., & Walker-Andrews, A. S. (2002). Mothers, fathers, and infants: The role of person familiarity and parental involvement in infants' perception of emotion expressions. *Child Development, 73*(5), 1339–1352.

Moore, G. A., Cohn, J. F., & Campbell, S. B. (2001). Infant affective responses to mother's still face at 6 months differentially predict externalizing and internalizing behaviors at 18 months. *Developmental Psychology, 37*(5), 706–714.

Mundy, P., Hogan, A., & Doehring, P. (1996). A preliminary manual for the abridged early social-communication scales. Retrieved from www.psy.miami.edu/faculty/pmundy

Murphy, F. C., Nimmo-Smith, I., & Lawrence, A. D. (2003). Functional neuroanatomy of emotions: A meta-analysis. *Cognitive, Affective, & Behavioral Neuroscience, 3*(3), 207–233.

Nichols, C. M., Ibanez, L. V., Foss-Feig, J. H., & Stone, W. L. (2014). Social smiling and its components in high-risk infant siblings without later ASD symptomatology. *Journal of Autism and Developmental Disorders, 44*(4), 894–902. https://doi.org/10.1007/s10803-013-1944-2

Nishida, T. K., & Lillard, A. S. (2007). The informative value of emotional expressions: 'Social referencing' in mother–child pretense. *Developmental Science, 10*(2), 205–212. https://doi.org/10.1111/j.1467-7687.2007.00581.x

Nwokah, E., & Fogel, A. (1993). Laughter in mother-infant emotional communication. *Humor: International Journal of Humor Research, 6*(2), 137–161. https://doi.org/10.1515/humr.1993.6.2.137

Nwokah, E. E., Hsu, H.-C., Davies, P., & Fogel, A. (1999). The integration of laughter and speech in vocal communication: A dynamic systems perspective. *Journal of Speech, Language, and Hearing Research, 42*(4), 880–894.

Nwokah, E. E., Hsu, H.-C., Dobrowolska, O., & Fogel, A. (1994). The development of laughter in mother-infant communication: Timing parameters and temporal sequences. *Infant Behavior & Development, 17*(1), 23–35.

Oller, D. K., Buder, E. H., Ramsdell, H. L., Warlaumont, A. S., Chorna, L., & Bakeman, R. (2013). Functional flexibility of infant vocalization and the emergence of language. *Proceedings of the National Academy of Sciences*. https://doi.org/10.1073/pnas.1300337110

Oster, H. (1978). Facial expression and affect development. In M. Lewis & L. A. Rosenblum (Eds.), *The development of affect* (pp. 43–74). New York, NY: Plenum Press.

Oveis, C., Gruber, J., Keltner, D., Stamper, J. L., & Boyce, W. T. (2009). Smile intensity and warm touch as thin slices of child and family affective style. *Emotion, 9*(4), 544–548. https://doi.org/10.1037/a0016300

Owren, M., & Amoss, R. (2014). Spontaneous human laughter. In *Handbook of positive emotions*. New York, NY: Guilford Press.

Ozonoff, S., Losif, A.-M., Baguio, F., Cook, I. C., Hill, M. M., Hutman, T., & Young, G. S. (2010). A prospective study of the emergence of early behavioral signs of autism. *Journal of the American Academy of Child & Adolescent Psychiatry, 49*(3), 256–266. https://doi.org/10.1097/00004583-201003000–00009.

Parlade, M. V., Messinger, D. S., van Hecke, A., Kaiser, M., Delgado, C., & Mundy, P. (2009). Anticipatory smiling: Linking early affective communication and social outcome. *Infant Behavior & Development, 32*, 33–43.

Phan, K. L., Wager, T. D., Taylor, S. F., & Liberzon, I. (2004). Functional neuroimaging studies of human emotions. *CNS Spectrums, 9*(4), 258–266.

Piaget, J. (1952). *Play, dreams and imitation in childhood*. New York, NY: Routledge.

Planalp, E. M., Van Hulle, C., Lemery-Chalfant, K., & Goldsmith, H. H. (2017). Genetic and environmental contributions to the development of positive affect in infancy. *Emotion, 17*(3), 412–420. https://doi.org/10.1037/emo0000238

Plooij, F. (1979). How wild chimpanzee babies trigger the onset of mother-infant play – and what the mother makes of it. In M. Bullowa (Ed.), *Before speech: The beginning of interpersonal communication* (pp. 223–243). London, UK: Cambridge University Press.

Reddy, V. (2000). Coyness in early infancy. *Developmental Science, 3*(2), 186–192.

Redican, W. K. (1975). Facial expressions in nonhuman primates. In L. A. Rosenblum (Ed.), *Primate behavior: Developments in field and laboratory research* (Vol. 4, pp. 103–194). New York, NY: Academic Press.

Rinn, W. E. (1984). The neuropsychology of facial expression: A review of the neurological and psychological mechanisms for producing facial expressions. *Psychological Bulletin, 95*(1), 52–77.

Rogers, S. J., & Puchalski, C. B. (1986). Social smiles of visually impaired infants. *Journal of Visual Impairment & Blindness, 80*(7), 863–865.

Ruch, W. (1993). Exhilaration and humor. In M. Lewis & J. M. Haviland (Eds.), *Handbook of emotions* (pp. 605–616). New York, NY: Guilford Press.

Ruvolo, P., Messinger, D., & Movellan, J. (2015). Infants time their smiles to make their moms smile. *PLoS One, 10*(9), e0136492. https://doi.org/10.1371/journal.pone.0136492

Rozga, A., Hutman, T., Young, G. S., Rogers, S. J., Ozonoff, S., Dapretto, M., & Sigman, M. (2011). Behavioral profiles of affected and unaffected siblings of children with autism: Contribution of measures of mother–infant interaction and nonverbal communication. *Journal of Autism and Developmental Disorders, 41*(3), 287–301. https://doi.org/10.1007/s10803-010-1051–6.

Rychlowska, M., Miyamoto, Y., Matsumoto, D., Hess, U., Gilboa-Schechtman, E., Kamble, S., & Niedenthal,

P. M. (2015). Heterogeneity of long-history migration explains cultural differences in reports of emotional expressivity and the functions of smiles. *Proceedings of the National Academy of Sciences, 112*(19), E2429–E2436. https://doi.org/10.1073/pnas.1413661112.

Samson, A., & Antonelli, Y. (2013). Humor as character strength and its relation to life satisfaction and happiness in Autism Spectrum Disorders. *Humor, 26*, 477–491.

Sarra, S., & Otta, E. (2001). Different types of smiles and laughter in preschool children. *Psychological Reports, 89*(3), 547–558.

Sasson, N. J., Dichter, G. S., & Bodfish, J. W. (2012). Affective responses by adults with Autism are reduced to social images but elevated to images related to circumscribed interests. *PLoS One, 7*(8), e42457. https://doi.org/10.1371/journal.pone.0042457

Sauter, D. A., McDonald, N. M., Gangi, D. N., & Messinger, D. S. (2014). Nonverbal expressions of positive emotions. In M. M. Tugade, M. N. Shiota, & L. D. Kirby (Eds.), *Handbook of positive emotions* (pp. 179–198). New York, NY: Guilford Press.

Schneider, K., & Josephs, I. (1991). The expressive and communicative functions of preschool children's smiles in an achievement-situation. *Journal of Nonverbal Behavior, 15*(3), 185–198.

Schneider, K., & Uzner, L. (1992). Preschoolers' attention and emotion in an achievement and an effect game: A longitudinal study. *Cognition and Emotion, 6*(1), 37–63.

Schultz, D., Ambike, A., Buckingham-Howes, S., & Cheah, C. S. L. (2008). Experimental analysis of preschool playmate preferences as a function of smiles and sex. *Infant and Child Development, 17*(5), 503–507. https://doi.org/10.1002/icd.566

Seder, J. P., Oishi, S. (2011). Intensity of Smiling in Facebook Photos Predicts Future Life Satisfaction. *Social Psychological and Personality Science, 3*(4), 407–413. https://doi.org/10.1177/1948550611424968.

Segal, L., Oster, H., Cohen, M., Caspi, B., Myers, M., & Brown, D. (1995). Smiling and fussing in seven-month-old preterm and full-term black infants in the still-face situation. *Child Development, 66*, 1829–1843.

Seibert, J. M., Hogan, A. E., & Mundy, P. C. (1982). Assessing interactional competencies: The early social-communication scales. *Infant Mental Health Journal, 3*(4), 244–258.

Skotko, B. G., Levine, S. P., & Goldstein, R. (2011). Self-perceptions from people with Down syndrome. *American Journal of Medical Genetics Part A, 155*(10), 2360–2369.

Slonims, V., & McConachie, H. (2006). Analysis of mother–infant interaction in infants with Down syndrome and typically developing infants. *American Journal on Mental Retardation, 111*(4), 273–289.

Song, R., Over, H., & Carpenter, M. (2016). Young children discriminate genuine from fake smiles and expect people displaying genuine smiles to be more prosocial. *Evolution and Human Behavior, 37*(6), 490–501. https://doi.org/10.1016/j.evolhumbehav.2016.05.002

Sroufe, A., & Waters, E. (1976). The ontogenesis of smiling and laughter: A perspective on the organization of development in infancy. *Psychological Review, 83*(3), 173–189.

Sroufe, L. A. (1995). *Emotional development: The organization of emotional life in the early years*. New York, NY: Cambridge University Press.

Stifter, C. A., & Moyer, D. (1991). The regulation of positive affect: Gaze aversion activity during mother-infant interaction. *Infant Behavior and Development, 14*, 111–123.

Striano, T., & Bertin, E. (2005). Coordinated affect with mothers and strangers: A longitudinal analysis of joint engagement between 5 and 9 months of age. *Cognition & Emotion, 19*(5), 781–790.

Symons, D., & Moran, G. (1994). Responsiveness and dependency are different aspects of social contingencies: An example from mother and infant smiles. *Infant Behavior and Development, 17*(2), 209–214.

Thelen, E., & Smith, L. B. (1994). *A dynamic systems approach to the development of cognition and action*. Cambridge, MA: MIT Press.

Thelen, E., & Ulrich, B. D. (1991). Hidden skills: A dynamic systems analysis of treadmill stepping during the first year. *Monographs of the Society for Research in Child Development, 56*(1), 1–103.

Thompson, J. (1941). Development of facial expression of emotion in blind and seeing children. *Archives of Psychology (Columbia University), 264*, 47.

Tomkins, S. S. (1962). *Affect, imagery, consciousness: The positive affects* (Vol. 1). New York, NY: Springer.

Troster, H., & Brambring, M. (1992). Early social-emotional development in blind infants. *Child: Care, Health and Development, 18*(4), 207–227.

Uljarevic, M., & Hamilton, A. (2013). Recognition of emotions in autism: A formal meta-analysis. *Journal of Autism and Developmental Disorders, 43*(7), 1517–1526. https://doi.org/10.1007/s10803-012-1695-5

van Hooff, J. A. R. A. M. (1972). A comparative approach to the phylogeny of laughter and smiling. In R. A. Hinde (Ed.), *Non-verbal communication* (pp. 209–241). London, UK: Cambridge University Press.

Van Egeren, L. A., Barratt, M. S., & Roach, M. A. (2001). Mother-infant responsiveness: Timing, mutual regulation, and interactional context. *Developmental Psychology, 37*(5), 684–697.

Venezia, M., Messinger, D. S., Thorp, D., & Mundy, P. (2004). The Development of Anticipatory Smiling. *Infancy, 6*(3), 397–406.

Waller, B. M., & Dunbar, R. I. M. (2005). Differential behavioural effects of silent bared teeth display and relaxed open mouth display in chimpanzees (*Pan troglodytes*). *Ethology, 111*(2), 129–142.

Washburn, R. W. (1929). A study of the smiling and laughing of infants in the first year of life. *Genetic Psychology Monographs, V*(5–6), 397–537.

Weiss, S. J., Wilson, P., Hertenstein, M. J., & Campos, R. (2000). The tactile context of a mother's caregiving: Implications for attachment of low birth weight infants☆. *Infant Behavior and Development, 23*(1), 91–111. https://doi.org/10.1016/S0163-6383(00)00030-8

Williams, P. L., Warick, R., Dyson, M., & Bannister, L. H. (1989). *Gray's anatomy*. Edinburgh, UK: Churchill Livingstone.

Witherington, D. C., Campos, J. J., & Hertenstein, M. J. (2001). Principles of emotion and its development in infancy. In G. Bremner & A. Fogel (Eds.), *Blackwell handbook of infant development* (pp. 427–464). Malden, MA: Blackwell.

Wolff, P. H. (1987). *The development of behavioral states and the expression of emotions in early infancy: New proposals for investigation*. Chicago, IL: The University of Chicago Press.

Wörmann, V., Holodynski, M., Kärtner, J., & Keller, H. (2012). A cross-cultural comparison of the development of the social smile: A longitudinal study of maternal and infant imitation in 6- and 12-week-old infants. *Infant Behavior and Development, 35*(3), 335–347. https://doi.org/10.1016/j.infbeh.2012.03.002

Wörmann, V., Holodynski, M., Kärtner, J., & Keller, H. (2014). The emergence of social smiling: The interplay of maternal and infant imitation during the first three months in cross-cultural comparison. *Journal of Cross-Cultural Psychology, 45*(3), 339–361. https://doi.org/10.1177/0022022113509134

Yale, M. E., Messinger, D. S., & Cobo-Lewis, A. B. (2003). The temporal coordination of early infant communication. *Developmental Psychology, 39*(5), 815–824.

Yarrow, L. J., Morgan, G. A., Jennings, K. D., Harmon, R. J., & Gaiter, J. L. (1982). Infants' persistence at tasks: Relationships to cognitive functioning and early experience. *Infant Behavior and Development, 5*(2), 131–141. https://doi.org/10.1016/S0163-6383(82)80023-4

Zwaigenbaum, L., Bryson, S., Rogers, T., Roberts, W., Brian, J., Szatmari, P. (2005). Behavioral manifestations of autism in the first year of life. *International Journal of Developmental Neuroscience, 23*, 143–152.

The Development of Anger

Jessica M. Dollar and Susan D. Calkins

Abstract

In this chapter, we use a biopsychosocial perspective to highlight how the experience and expression of anger, as well as skills to regulate anger, develop from complex transactional processes across time and are associated with various aspects of adjustment or maladjustment. In particular, our goals are to (1) provide a discussion of the definition and functional significance of anger; (2) describe the development of anger, including its expression and regulation, at the behavioral and biological levels and within the context of interpersonal relationships; (3) provide a selective review of the links between the expression and regulation of anger and adjustment in terms of externalizing and internalizing behavior problems, social and academic adjustment, and aspects of physical health; and (4) discuss challenges for future research.

Anger is one of the earliest emotions that humans develop. As a naturally occurring phenomenon, anger is a part of most individuals' everyday experiences in response to, and in an attempt to overcome, obstacles to desired objects, individuals, and events (e.g., Barrett & Campos, 1987; Saarni, Campos, Camras, & Witherington, 2006). Despite the consistent role that anger plays across development, considerable change takes place in terms of its presence and intensity, especially from infancy through adolescence (Braungart-Rieker, Hill-Soderlund, & Karrass, 2010; Cole et al., 2011; Denham, Lehman, Moser, & Reeves, 1995; Larson & Asmussen, 1991; Putnam, Gartstein, & Rothbart, 2006; Rothbart, Ahadi, Hershey, & Fisher, 2001). Moreover, there is a wide variation in the intensity and frequency of anger experiences and expressions across individuals, as well as how the experience of anger is managed, ranging from constructive strategies to avoidance to aggressive behavior. Thus, although anger can serve adaptive purposes, inappropriate levels and/or expressions of anger may engender behaviors that can incur long-term costs, such as negatively influencing social interactions, preventing adaptive problem-solving, contributing toward the development of mental health difficulties, and/or negatively affecting one's physical health (e.g., Barefoot, Dodge, Peterson, Dahlstrom, & Williams, 1989; Casey & Schlosser, 1994; Cole, Teti, & Zahn-Waxler, 2003; Eisenberg, Fabes, Nyman, Bernzweig, & Pinuelas, 1994).

In this chapter, we employ a biopsychosocial perspective (Calkins, 2011) to highlight the idea that the experience and expression of anger, as

J. M. Dollar (✉) · S. D. Calkins
University of North Carolina—Greensboro, Department of Human Development and Family Studies, Greensboro, NC, USA
e-mail: jmdollar@uncg.edu

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_9

well as skills to modulate anger, develop from complex transactional processes within the individual and between the individual and his/her environment and across time. Importantly, a biopsychosocial perspective incorporates a conceptual integration of processes that are measurable across biological, behavioral, and social levels of analysis to account for developmental patterns of child adjustment within the child's social context. Thus, this perspective highlights the importance of multilevel work that accounts for the processes associated with children's development of anger expressions and its regulation, within the context of families and the broader environment, while also acknowledging the important contributions of underlying biological processes. We believe that such a perspective is needed to understand both normative and nonnormative developmental processes associated with anger.

Using a biopsychosocial perspective as a guide, we begin with a discussion of the definition and functional significance of anger. We then describe the development of anger, including its expression and regulation, at the behavioral and biological levels and within the context of interpersonal relationships. This discussion includes acknowledgment of the normative development of anger, as well as important individual differences in its expression and regulation, from infancy through adolescence. We then provide a selective review of the links between the expression and regulation of anger and adjustment in terms of externalizing and internalizing behavior problems, social and academic adjustment, as well as aspects of physical health. We end with a brief discussion of challenges for future research.

Definition of Anger

Typically, anger is associated with discrete facial and bodily expressions including bodily tensing, an arched back, furrowed brow, and/or a squaring of the mouth (Alessandri, Sullivan, & Lewis, 1990; Izard, 1977), and its expression is widely considered to be the result of psychological or physical interference with a goal-directed activity (Izard, 1977; Lewis, Ramsay, & Kawakami, 1993). For instance, individuals feel anger when their efforts toward obtaining a goal or reward are hindered. And, feelings of anger arise when individuals feel as though what "ought" to happen does not, in fact, occur (Carver & Harmon-Jones, 2009; Depue & Lacono, 1989; Frijda, 1986). Most emotion theories connect anger to approach motivation (i.e., movement toward the perceived source of the anger) and the association between anger and approach motivation is thought to be bidirectional (Angus, Kemkes, Schutter, & Harmon-Jones, 2015). Thus, not only does anger occur when approach behavior is blocked, but the reverse also occurs, such that feelings of anger may motivate the individual to approach the source of anger. Indeed, in line with a functionalist perspective of emotions, a primary purpose of anger is to overcome obstacles in order to achieve one's goals (Barrett & Campos, 1987; Saarni et al., 2006), such that feelings of anger may motivate the individual to approach the source of anger. For example, anger may promote behavior to remove the violation of what "ought" to be, as an effort to reopen the path of the desired goal, such as when an angry child attempts to get a toy that has been taken from her.

Behavioral and neurophysiological research provides evidence that anger is associated with increased approach behavior and reward-related motivation (Carver & Harmon-Jones, 2009; Harmon-Jones, 2007; Harmon-Jones, Harmon-Jones, Abramson, & Peterson, 2009; van Honk, Harmon-Jones, Morgan, & Schutter, 2010). Neurophysiological work with adults highlights the relation between anger and asymmetrical frontal cortical activity associated with approach motivation using the electroencephalogram (EEG) methodology. Contrary to the previous work that confounded affective valence (positive vs. negative affect) with motivational direction (approach vs. withdrawal), Harmon-Jones and Allen (1998) found that trait anger was associated with increased left frontal activity and decreased right frontal activity during resting baseline, which is commonly associated with approach behavior. Moreover, experimental manipulations indicate that state anger is associated with relative left frontal activation

(Harmon-Jones & Sigelman, 2001). Thus, these and additional studies (e.g., Carver & Harmon-Jones, 2009; Harmon-Jones, 2004; Harmon-Jones & Allen, 1998) suggest that anger is associated with approach motivation to blocked goals.

Behavioral investigations also provide support for the association between anger and approach behavior. For example, infant anger during goal blockage was associated with increased behavior (e.g., arm pulling) to overcome an obstacle and increased positive emotions once the obstacle was removed (Lewis & Ramsay, 2005; Lewis, Ramsay, & Sullivan, 2006; Lewis, Sullivan, Ramsay, & Alessandri, 1992). Results from these studies suggest that anger may maintain and increase task engagement and approach motivation. Moreover, correlational behavioral studies indicate that infants prone to experience anger also exhibit strong approach tendencies (Derryberry & Rothbart, 1997; Fox, 1989; Kochanska, Coy, Tjebkes, & Husarek, 1998). For example, anger observed in a laboratory task designed to elicit anger/frustration at 10 months of age was positively associated with parental report of approach at 7 years of age. In addition, 2–5-year-old children who displayed anger in a frustrating context showed greater approach behaviors when aiming to overcome obstacles (He, Xu, & Degnan, 2012). In sum, behavioral and neurophysiological work provides evidence for the association between anger and approach tendencies across the life span, thereby supporting the central theorized function of anger.

The Development of Anger

Despite the consistent functional role that anger plays across the life span, considerable change takes place in terms of its emergence and intensity. Displays of distress and irritability, but not anger, are evident from birth. Although there are different perspectives as to when discrete anger is discernable (Bennett, Bendersky, & Lewis, 2002, 2004; Camras, 1992, 2004; Izard, 1977, 2004; Oster, 2005), most emotion theorists agree that discrete anger is detectable by 6 months of age. Normatively, the average level of expressed anger is relatively low in early infancy but then increases in late infancy and through the second year of life, before declining across toddlerhood and into early childhood (Braungart-Rieker et al., 2010; Denham et al., 1995; Putnam et al., 2006). Indeed, it is common to see toddlers tantrumming in a grocery store aisle because they are not allowed to hold a box of cookies or a preschooler defiantly telling his mother than he is not leaving the park given the normalcy of toddler's occasional expressions of intense anger (Potegal, Kosorok, & Davidson, 1996). However, a central part of adaptive emotional development is for these anger expressions (frequency, duration, intensity) to decline from toddlerhood into early childhood (Cole et al., 2011). The average level of anger does not change across middle childhood (Deater-Deckard et al., 2010; Kim et al., 2010), but it increases again in preadolescence and adolescence (Larson & Asmussen, 1991). For instance, it is considered normative for adolescents to show frequent expressions of anger, ranging from indignation and resentment to rage, especially toward parents who are seen by the adolescent as limiting their independence.

Various explanations, all involving the emergence of developing abilities and skills, have been posed as to why normative expressions of anger change across development. For example, increased cognitive abilities across infancy and toddlerhood allow children to better understand that a goal has been blocked and that they are capable of mobilizing efforts to alter the situation. Moreover, during this period of development, children become better able to communicate their wants in response to a frustrating situation, although sometimes in an inappropriate manner (Lewis, Alessandri, & Sullivan, 1990). In addition, as will be discussed in greater detail below, important self-regulatory abilities develop across infancy and into childhood that likely explain, at least in part, the decrease in anger across this developmental period. Similarly, increases in anger across the adolescent period have been explained by a lag in developing cognitive self-regulatory abilities (Steinberg, 2004), as well as

the frustration that ensues from parental attempts to constrain their growing autonomy.

Importantly, although anger is experienced and expressed by nearly everyone, there are significant individual differences in the expression of anger that complicate our understanding of its normative development. These individual differences are often discussed as reflecting, at least in part, a child's temperament, defined as early emerging, relatively stable individual differences in the realms of affectivity, activity level, attention, and self-regulation (Rothbart & Bates, 2006; Shiner et al., 2012; Stifter & Dollar, 2016). From a temperament perspective, individuals are prone to experience and express emotions and behaviors, such as anger reactivity, at different frequencies and intensities across situations. For example, when a parent removes an object that the child should not be playing with, some children show intense displays of anger, such as screaming and hitting, whereas others remain calm and move on to another activity. Thus, there are some individuals who are prone to experience low levels of anger from infancy onward, whereas other individuals are quick to experience anger at intense levels and frequencies.

In a seminal study on anger reactivity (Calkins, Dedmon, Gill, Lomax, & Johnson, 2002), infants were classified as easily frustrated or less easily frustrated based on multiple laboratory tasks designed to elicit anger/frustration. The easily frustrated infants were less attentive and more active, as well as more reactive physiologically and less able to regulate physiological reactivity than less easily frustrated infants, thus highlighting early individual differences in anger reactivity and associated behaviors/physiology. More recently, Brooker and colleagues (2014) found evidence for three groups of children based on their anger expressions across infancy: a low-anger group, a high-anger group, and an increasing-anger group. Infants in the low-anger group showed low anger at 6 and 12 months of age across various tasks. Infants in the high-anger group displayed decreasing anger from 6 to 12 months of age; however, infants in this group had expressions of anger that remained high relative to other children across time. Finally, infants in the increasing-anger profile expressed moderate levels of anger at both time points but also showed relative increases in anger between the 6- and 12-month assessments. This pattern of anger expression is what would be expected to occur normatively across this period. Thus, results from these studies, and numerous others, highlight that from infancy there are important variations in an individual's tendency to experience and express anger.

In sum, significant developmental patterns occur in terms of the experience and expressions of anger across the life span. Moreover, there are individual differences in children's expressions of anger, such that some children are prone to experience more frequent and/or intense bouts of anger (i.e., yelling, tantrumming, hitting) than others. Children who show high stable expressions of anger across development are at greater risk for difficulties across a variety of realms (e.g., Cole et al., 2003; Denham et al., 2002; Eisenberg et al., 2001). The prevailing perspective is that children who are quicker to experience intense anger without the ability to modulate that arousal are more likely to engage in maladaptive behaviors (Vitaro, Brendgen, & Tremblay, 2002). Thus, although anger serves an adaptive purpose (Barrett & Campos, 1987) and it is important to remember that anger is not inherently problematic, it is critical that children learn how to deal with blocked goals in an appropriate manner. Thus, we now turn to a discussion on the importance of anger regulation.

The Regulation of Anger

One of the most significant aspects of social and emotional development is the acquisition of skills that allow children to modulate anger and other negative emotions (Blair & Diamond, 2008). Although intense expressions of anger are considered typical toddler behavior (Potegal et al., 1996), frequent and/or intense expressions of anger by preschool- and school-age children are problematic (Cole, Zahn-Waxler, & Smith, 1994; Shaw, Bell, & Gilliom, 2000). The normative changes that take place in the experience and

expression of anger can be attributed, at least in part, to developmental changes in emotion regulation abilities (Kopp, 1989). For example, developmental periods when anger is generally higher, such as in toddlerhood and early adolescence, are followed by periods of rapid growth in self-regulatory abilities in childhood and late adolescence.

Drawing from theoretical and empirical work in the developmental (Cole, Martin, & Dennis, 2004) and clinical fields (Keenan, 2000), we define emotion regulation as those behaviors, skills, and strategies, whether conscious or unconscious, automatic or effortful, that serve to modulate, inhibit, and enhance emotional experiences and expressions (Calkins & Leerkes, 2011). The acquisition of such skills is a central developmental task that promotes context-appropriate behavior and supports social relationships (Kopp, 1989), both of which are underlying components of adaptive psychological functioning. Across infancy and early childhood, remarkable growth occurs in children's ability to regulate emotional arousal, including anger. Biological changes, including neurobiological changes in adrenocortical and parasympathetic systems and development in the prefrontal cortex (Hostinar & Gunnar, 2013), significantly contribute to infants' developing regulatory abilities. Infants' early efforts to modulate emotions are regulated largely by primitive mechanisms of self-soothing, such as sucking and turning one's head away (Kopp, 1982). In the second half of the first year, infants develop the ability to voluntarily control arousal largely by attentional control and the engagement of simple motor skills (Posner & Rothbart, 2000).

By the second year of life, infants are more independent in their regulatory abilities (Calkins & Dedmon, 2000). These skills, in addition to the ability to comply with caregiver directives and requests, are supported by significant development of other emotional, motor, language, and cognitive abilities (Kopp, 1989). For instance, improved language abilities assist children to more constructively regulate anger by appropriately expressing their needs with words and to think before acting when frustrated (Cole, Armstrong, & Pemberton, 2010). Children's regulatory abilities become more flexible in preschool, thereby promoting their ability to regulate behavior through context-appropriate emotions, plan suitably, and process social information accurately (Thompson, Lewis, & Calkins, 2008). Compared to infants and toddlers, children express less frequent anger in early childhood (Denham, 1998), and it becomes more context-dependent and context-appropriate. Additionally, for most children, temper tantrums and physical aggression decrease over preschool age and early childhood (Lemerise & Dodge, 2008; NICHD ECCRN, 2004; Shaw, Gilliom, Ingoldsby, & Nagin, 2003; Tremblay, Masse, Pagani-Kurtz, & Vitaro, 1996). A recent study highlights the important developmental changes that occur in children's expressions of anger and regulatory abilities (e.g., self-initiated distraction); when children were 18 and 24 months old, on average, they had quick angry reactions and were slower to distract themselves than at later ages. But, by 36 and 48 months of age, children were quicker to use distraction, and anger expressions were briefer and occurred later in the task (Cole et al., 2011).

By elementary school age, children are aware that they are expected to regulate anger within the peer group (Underwood, 1997), and behaving angrily toward peers is associated with increased peer rejection, peer victimization, and/or becoming a bully or victim of a bully (Eisenberg et al., 2005; Hanish, Kochenderfer-Ladd, Fabes, Martin, & Denning, 2004; Salmivalli & Nieminen, 2002). Emotion regulation abilities, including those used to modulate anger, continue to be important in middle childhood and adolescence. As children develop increased attentional abilities, memory, and cognitive function in middle childhood, regulatory strategies become more internal and cognitively based (Kopp, 1982). Indeed, the improvements that occur in the regulation of anger and other emotions across childhood take place in conjunction with improvements in attention and cognitive abilities (i.e., executive function, Posner & Rothbart, 2007), as well as more adaptive behavioral strategies to regulate anger.

At this point in development, children are better able to use active and planful regulatory strategies, such as reframing situations and distracting themselves from frustrating situations (Kalpidou, Power, Cherry, & Gottfried, 2004). It is thought that these abilities are especially important during this developmental period, because new academic and social challenges are presented, and the ability to successfully emotionally regulate assists the child to meet these new challenges. For example, the ability to successfully regulate anger lowers the likelihood that a child will act out and behave destructively in the school context or internalize negative emotions that could lead to increased anxiety or depression. Anger regulation abilities may also assist a child to attend to multiple perspectives during challenging social interactions, possibly resulting in stronger friendships and being better liked by her peers. By adolescence, children can identify long-term consequences of their behavior and thus are better able to decide when to use long- or short-term strategies to regulate their emotions (Moilanen, 2007). In addition, most adolescents can engage in sophisticated regulation strategies, both verbal and facial, to hide their anger in front of peers to behave in an appropriate manner and meet social goals (Shipman, Zeman, & Stegall, 2001).

Importantly, although emotion regulation abilities are discussed as progressively improving across time, some developmental transitions, such as during late childhood into adolescence, may result in a normative deviation from a linear increase in self-regulatory abilities. For instance, emotional arousal may be heightened in adolescence because neither the self-regulation nor risk/reward systems are fully mature (Steinberg, 2004). It has been argued that rapidly developing subcortical brain areas and hormonal changes that accompany puberty enhance sensitivity to reward in adolescence, whereas prefrontal cortical areas that underlie self-regulation are still developing, and this developmental asynchrony may increase some adolescents' vulnerability to emotion-related risk-taking behaviors (Casey & Caudle, 2013).

In sum, dramatic growth occurs in emotion regulatory abilities across early development, explaining, at least in part, the normative patterns of anger expressions. From a biopsychosocial perspective, it is essential to acknowledge how children's expression and regulation of anger develop within the context of families and the broader environment, as well as acknowledging the important contribution of underlying biological processes (Calkins, 2011). Therefore, we now turn to a discussion of biological and environmental influences on children's expression and regulation of anger.

Factors Influencing the Expression and Regulation of Anger

Biological Factors

Empirical and theoretical work has highlighted the underlying biological components (i.e., genes, neural, cardiovascular) of individual differences in the expression and regulation of anger using a variety of physiological measures. For instance, in anatomical and functional animal and human research, the amygdala and superior temporal sulcus regions of the brain have been shown to be involved in processing information relevant to anger. In addition, the dorsal anterior cingulate cortex and the prefrontal cortex are involved in experience, rumination, expression, and regulation of anger (Denson, Pedersen, Ronquillo, & Nandy, 2009; Grandjean et al., 2005). As previously discussed, there has also been significant work that links neural activation to individual's experience and expression of anger. For instance, EEG research in adult samples has shown particular patterns of neural activity associated with anger, such that anger and approach motivation are associated with increased left frontal cortical activity and decreased right frontal cortical activity during resting baseline (e.g., Harmon-Jones & Allen, 1998; Harmon-Jones & Sigelman, 2001).

There is also a substantial body of work within the developmental literature that highlights the parasympathetic nervous system as playing a significant role in the regulation of anger, as well as

the regulation of attention, cognition, and other emotions. The myelinated vagus nerve (i.e., tenth cranial nerve) provides input into the heart, producing dynamic changes in cardiac activity that allow the body to transition between sustaining metabolic processes and generating responses to the environment (Porges, 2007). Vagal regulation of the heart when the individual is emotionally challenged has been of interest to researchers studying emotion regulation.

This body of work has largely focused on children's vagal regulation during laboratory situations that elicit anger (e.g., Calkins & Dedmon, 2000; Calkins, Graziano, & Keane, 2007). During situations that do not present a challenge, the vagus nerve inhibits the sympathetic nervous system's influence on cardiac activity through increased parasympathetic influence, thereby creating a relaxed and restorative state (Porges, 1995). When an external or emotionally taxing demand is placed on the child, such as when the child is angered, vagal influence is withdrawn or suppressed, resulting in increased sympathetic activity. This modulated increase in sympathetic influence leads to an increase in heart rate and the focusing of attention, which is required for effective emotional responding (Bornstein & Suess, 2000). In this way, the withdrawal of PNS influence during anger-inducing, challenging situations, as evidenced by decreased vagal activity, can be used as an indicator of an individual's physiological regulation of anger. Greater vagal regulation during infancy and early childhood is most often associated with adaptive outcomes, such as greater behavioral regulation (e.g., Calkins & Dedmon, 2000) and fewer behavior problems (e.g., Graziano & Derefinko, 2013).

There is also evidence of underlying genetic contribution to individual differences in infants' and children's expression of anger from behavioral genetics studies involving twins and adoptees (e.g., Deater-Deckard, Petrill, & Thompson, 2007; Gagne & Goldsmith, 2011; Goldsmith, Buss, & Lemery, 1997; Saudino, 2005). For example, Gagne and Goldsmith (2011) reported significant genetic influences on anger reactivity as assessed by parents, as well as anger coded by trained observers in the lab. Overall, this body of research suggests that 40–70% of the variance in trait-level/temperamental anger is heritable. Evidence for the genetic contribution to trait-level anger also comes from molecular genetic studies. For instance, the underlying biology of anger and aggression has implicated the dysregulation of serotonergic activity (e.g., Virkkunen & Linnoila, 1993), although this association may function differently for males and females (Suarez & Krishnan, 2006). The dopamine D4 receptor (*DRD4*) gene has also been implicated as a candidate gene for anger, along with additional temperamental traits (Saudino, 2005). In addition, the norepinephrine system receptor gene *ADRA2A* (Comings et al., 2000) and the *TBX 19* gene (Wasserman, Geijer, Sokolowski, Rozanov, & Wasserman, 2007) have been implicated as candidate genes for trait anger.

This growing body of work suggests that trait-level anger is moderately to substantially heritable; but, identification of specific genes that account for the genetic variance is challenging for a variety of reasons including small effect sizes, difficulty with replication, and gene x gene and gene x environment interactions that create individual differences in temperamental anger (e.g., Pickles et al., 2013). Importantly, although one's biology is thought to significantly influence individual differences in anger, children learn about the appropriate expression and regulation of anger within the context of caregiver-child interactions, as well as the peer context; thus, we now move to a discussion of how the anger expressions are influenced by the social environment.

Socialization and the Environment

Extensive research highlights that although the expression and regulation of anger is grounded in early biological influences, these emotional responses are also significantly shaped by environmental influences. Caregivers, in particular, are faced with an important role to teach children how to express and regulate anger, as well as other emotions, in a manner that is culturally

appropriate and socially adaptive (Lengua & Wachs, 2012). Indeed, it is widely accepted that caregiving practices may support or undermine development and thus contribute to observed individual differences among young children's emotional abilities (Morris, Silk, Steinberg, Myers, & Robinson, 2007; Thompson, 1994). Interactions with parents in emotion-laden contexts teach children that the use of particular strategies may be more useful for the reduction of emotional arousal than other strategies (Sroufe, 1996). Moreover, the degree to which caregivers appropriately read and respond to infants' distress in ways that minimize arousal or elicit positive interaction allows the infant to learn from and integrate these experiences into an emerging behavioral repertoire of regulatory capacities (Calkins, Perry, & Dollar, 2016). For example, when parents help a child to modulate anger by shifting her attention from a toy that she desires but cannot have, they help her cope with the experience of anger and, ultimately, teach her that distraction is not only a socially appropriate strategy but one that may also be effective in similar situations that she may later encounter on her own.

Although multiple aspects of the caregiving environment are thought to contribute to children's expression and regulation of emotions, including anger (Eisenberg, Cumberland, & Spinrad, 1998; Morris et al., 2007), the attachment relationship between caregivers and infants is hypothesized to be especially significant (Bowlby, 1969/1982). Secure attachment relationships, which are developed through sensitive and supportive caregiver responses to the infant especially in times of stress or external threat, increase children's expectations about their own ability to respond to environmental challenges. Further, a secure attachment relationship is believed to increase the infant's expectations that the caregiver will be available and successful at reducing the child's arousal if needed. In turn, the shift from dyadic to the child's ability to self-regulate is thought to develop through increased exploration and confidence in their own skills to engage in and navigate emotionally charged situations (Sroufe, 1996).

Empirical evidence supports the important influence that the attachment relationship has in promoting appropriate expressions and methods of regulating anger. For instance, mother-infant attachment security was associated with more positive and less negative affect expressions in the laboratory tasks designed to elicit frustration and fear, suggesting more adaptive emotion regulation among secure children (Smith, Calkins, & Keane, 2006). In addition, infants in a secure attachment relationship were less likely than infants classified as insecurely attached-avoidant to show high negative affect and defiance in compliance task in toddlerhood (NICHD ECCRN, 2004). In studies examining maternal behavior thought to be reflective of insecure attachment relationships (i.e., intrusive, controlling behavior), maternal negative and controlling behavior was associated with less adaptive regulatory strategies in a frustrating task (Calkins, Smith, Gill, & Johnson, 1998). One can expect that, for example, if an overcontrolling parent removes a young child from a situation where, for a successful peer interaction, she needs to control her emotions/behavior in order to share a toy, she may not develop the skills to navigate that situation in socially appropriate ways when a parent is not present.

Additional work has examined how parents socialize children's expression and regulation of emotions, including anger, through such mechanisms as parental modeling, contingent reactions to children, and teaching mechanisms (Denham, Bassett, & Wyatt, 2007; Eisenberg et al., 1998; Morris et al., 2007). For instance, intense and frequent expression of anger within parent-child interactions is associated with lowered abilities to appropriately regulate anger and aggressive behaviors (Denham, Mitchell-Copeland, Strandberg, Auerbach, & Blair, 1997; Rubin, Burgess, Dwyer, & Hastings, 2003; Smeekens, Riksen-Walraven, & van Bakel, 2007; Snyder, Stoolmiller, Wilson, & Yamamoto, 2003). Research on the role of caregiver reactions to children's emotions, parents' nonsupportive, has shown that negative reactions to children's anger were related to maladaptive outcomes (Eisenberg, Fabes, & Murphy, 1996; Gottman, Katz, &

Hooven, 1996). For example, if a parent dismisses or discourages a child's expression of anger, he might learn to think of all experiences of anger as "bad" and, therefore, suppress and/or miss opportunities to learn how to regulate anger. Parents' negative reactions to children's anger are also likely to intensify children's emotional arousal, thereby increasing the likelihood that these children will engage in dysregulated behavior. Finally, through conversations parents can discuss the causes and consequences of emotions. In these conversations parents may teach their children strategies for regulating emotion, such as taking a deep breath, thinking of something positive, or redirecting their child's attention from the source of the anger. Therefore, children of parents who encourage talking about emotions may be better emotion communicators and better able to regulate emotional arousal (Gottman et al., 1997).

Extensive work has considered how different parenting behaviors may be especially important for anger-prone children who might have difficulty otherwise developing these skills (Calkins et al., 1998). For example, sensitive parenting behaviors are thought to help easily frustrated children to develop appropriate regulatory abilities, possibly by identifying anger and strategizing ways that they can deal with that anger, thus facilitating greater social skills for emotionally reactive children. On the other hand, intrusive, controlling, and/or hostile caregiving behavior may exacerbate the child's proneness toward anger, lowering the likelihood that they learn how to appropriately regulate their affect, which may lead to behavior problems (Bates, Pettit, Dodge, & Ridge, 1998). Thus, the effects of negative parenting behaviors likely are especially detrimental to anger-prone children, given that low-quality and negative parenting seem to amplify behaviors already at risk (Calkins & Fox, 2002; Morris et al., 2002). Recently, Kochanska and Kim (2012) provided important empirical evidence regarding the mechanisms for anger-prone children's developmental trajectories. In insecurely attached dyads, children who were anger-prone elicited more power-assertive discipline from their parents; in turn, the power-assertive discipline was associated with greater levels of antisocial behavior later in development. However, in relationships characterized by security, variations in children's anger were not associated with parent's power-assertive behavior, and, in turn, power assertion was not associated with antisocial behavior.

Importantly, entry into the formal school environment drastically alters the people that children interact with the most. Moreover, given children's desire to be well-liked and the strong peer group norms for the expression and regulation of anger (Lemerise & Dodge, 2008; Parker & Gottman, 1989), peers become increasingly important across development for socializing the expression and regulation of anger. For example, children understand that excessive anger expressions, such as aggressive behavior, are negatively viewed by peers by middle childhood (Shipman, Zeman, Nesin, & Fitzgerald, 2003). The rise of participation in situations with varying social partners presents children with more opportunities to develop sophisticated emotion regulation skills. The time that children spend with their friends allows the opportunity to practice interpersonal skills that are not provided by the parent-child relationship (Laursen, Finkelstein, & Betts, 2001), and maintaining friendships presents the opportunity to develop and practice conflict resolution skills and learn about the outcomes of these strategies (Fonzi, Schneider, Tani, & Tomada, 1997). On the other hand, children who are aggressive and have difficulty regulating anger are considered socially unskilled by their peers, and as a result, these children are less likely to engage in positive peer interactions and develop friendships that provide beneficial socialization opportunities. Indeed, it is important to consider the other side of this socialization process as well; specifically, if children are friends with those who engage in maladaptive behaviors, the friendship may impede anger regulation development instead of serving as a resource. In sum, the expression and regulation of anger is based in early biological influences and continues to develop within the context of social interactions. Importantly, there is an extensive literature highlighting that inappropriate,

dysregulated expressions of anger are associated with a host of maladaptive outcomes. We now turn to a selective review of this work.

Anger and Functioning

Although anger can serve an adaptive purpose (Barrett & Campos, 1987; Saarni, Mumme, & Campos, 1998), inappropriate intensities and/or expressions of anger can also lead to aggressive or socially unsuitable behaviors that may incur long-term costs. For example, children who show inappropriate expressions of anger will likely have trouble developing appropriate social skills and thus have greater difficulty interacting with peers and building positive relationships; in turn, lowered social skills may negatively impact children's subsequent academic competencies as well as put them at risk for engaging in later delinquent, aggressive behaviors. Indeed, intense and/or frequent expressions of anger are associated with a range of maladaptive outcomes ranging from children's externalizing behaviors, negatively influencing peer interactions, preventing socially adaptive problem-solving abilities, and/or promoting deleterious effects on one's physical health (Barefoot et al., 1989; Casey & Schlosser, 1994; Cole et al., 2003; Eisenberg et al., 1994). Given the significant role that anger plays in children's trajectories toward well-being or maladjustment, extensive empirical and theoretical work has examined these associations. We now provide a selective review of this work.

Externalizing Behaviors

Considerable evidence suggests that although externalizing behaviors, defined as aggressive, destructive, and oppositional behaviors, peak around age 2 and show a normative decline across early childhood (Hartup, 1974; Kopp, 1982), some children continue to show high levels of externalizing behaviors beyond childhood (e.g., Campbell, Spieker, Vandergrift, Belsky, & Burchinal, 2010). For example, in our own work, we identified four trajectories of externalizing behaviors from age 2 to age 15: a low/stable group (children who showed low and stable patterns of externalizing behaviors from early childhood into adolescence), a childhood decreasing group (children who showed a normative decline in externalizing behaviors across early childhood and remained low into adolescence), a high/stable group (children who showed an elevated pattern of externalizing behaviors across childhood and adolescence), and a childhood increasing group (children who showed a significant increase in externalizing behaviors starting at age 7 through adolescence) (Perry, Calkins, Dollar, Keane, & Shanahan, 2017). Importantly, high stable levels of externalizing behavior problems are associated with the greatest risk for later maladjustment including conduct disorder, attention deficit hyperactivity disorder, social difficulties, school failure, and delinquent behavior (e.g., Campbell, 2002; Campbell, Shaw, & Gilliom, 2000; Fergusson, Lynskey, & Horwood, 1996; Loeber, Farrington, Stouthamer-Loeber, Moffitt, & Caspi, 1998).

Across decades of research, the relation between anger and externalizing behaviors has been reported repeatedly (Eisenberg et al., 2009; Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002; Lemery, Essex, & Smider, 2002; Lengua, 2006; Rothbart, Ahadi, & Hershey, 1994; Rothbart, Derryberry, & Hershey, 2000; Rydell, Berlin, & Bohlin, 2003). Some of the earliest work on the association between anger and externalizing spectrum problems was conducted in clinical or at-risk samples of children (Barron & Earls, 1984; Bates, Bayles, Bennett, Ridge, & Brown, 1991; Campbell, 1990; Shaw, Keenan, & Vondra, 1994). The guiding perspective behind this research was that children who were quick to experience and express anger were more likely to engage in aggressive and destructive behavior. Moreover, these anger-prone children may behave aggressively when provoked due to their tendency to perceive these provocations as hostile in nature (Vitaro et al., 2002).

The association between anger and externalizing behaviors is found in cross-sectional and longitudinal work from infancy through adolescence and beyond. For instance, observed infant

frustration is predictive of parent-rated aggression in 7-year-old children (Rothbart et al., 2000). Brooker and colleagues (2014) reported that infants in the high-anger group (based on observations at 6 and 12 months of age) were rated as showing greater behavior problems at age 3 than children in the normative, increasing-anger group (consisting of children who expressed moderate but increasing levels of anger between the 6- and 12-month assessments as would be expected to occur normatively). In preschool, children high in parent-rated anger were more likely to be rated as high in externalizing behavior problems by teachers in preschool and elementary school and by parents at home (Rydell et al., 2003). In addition, high levels of anger at 4.5 years directly predict high levels of conduct disorder symptoms at 6 and 7 years old (Nozadi, Spinrad, Eisenberg, & Eggum-Wilkens, 2015). Importantly, both the intensity and frequency of anger expressions are associated with externalizing symptoms in childhood (Hernández et al., 2015).

Evidence for the association between anger expressions and externalizing behavior problems has also been found into preadolescence and adolescence. In our own work, we found that dysregulated anger at 5 years of age was associated with greater odds of being in a high/stable externalizing trajectory instead of a decreasing externalizing trajectory from age 2 to age 15 (Perry et al., 2017). Wang and colleagues (2016) reported that childhood anger predicted parent reports of externalizing and co-occurring externalizing and internalizing behavior problems. In addition, adolescent anger predicted parent reports of pure externalizing problems, as well as both parent- and teacher-reported co-occurring problems. Thus, there is strong evidence that high levels of anger are dysregulated in nature such that they can impede rather than aid goal pursuit (Cole, Michel, & Teti, 1994), placing individuals at risk for later externalizing behavior problems.

Unfortunately, the association between anger and externalizing behavior problems is not always clear. As noted, there is a normal developmental trajectory in which most children show early expressions of anger and aggression; whereas most children decrease in these aggressive behaviors, other children go on to have behavioral and social difficulties (Campbell, 1990; Tremblay et al., 1999). Considerable work has aimed to identify processes and mechanisms that identify the individual and environmental conditions that contribute to the lowering of anger and aggressive behaviors over time. The moderating effects of emotion and behavioral regulation, in particular, have been examined extensively to explain the association between anger and problem behavior. Notably, Eisenberg and colleagues (e.g., Eisenberg, Fabes, Guthrie, et al., 1996; Eisenberg et al., 1995; Eisenberg et al., 1994, 2001, 2007, 2009; Hernández et al., 2015; Nozadi et al., 2015; Wang et al., 2016) have conducted a series of investigations addressing the interaction of negative emotionality/anger and regulatory abilities in the prediction of behavior problems and social difficulties. This program of research has consistently demonstrated that children high in anger but lacking regulatory skills are more likely to develop social difficulties and behavior problems, especially within the externalizing realm.

Evidence for this association has come from other laboratories, as well. Moran and colleagues (2013) found that 3-year-old children with higher levels of observed anger showed higher externalizing behaviors but only when the children had poor regulation skills. Deater-Deckard et al. (2007) found that the link between anger reactivity and aggressive behavior was mediated by children's regulation of sustained attentive behavior, an important skill used to modulate anger. The regulation of the physiological manifestation of anger has also been examined. For example, greater physiological regulation, as measured by vagal withdrawal, can lower the likelihood that anger-prone children show high levels of disruptive/aggressive behavior from ages 2 to 5 years (Degnan, Calkins, Keane, & Hill-Soderlund, 2008).

Of note, the moderating effect of regulatory abilities is not found for some children (e.g., Nozadi et al., 2015); therefore, additional factors are believed to attenuate or exacerbate risk for anger-prone children's development of

externalizing behaviors. For example, anger-prone children are more likely to interpret others' cues as angry or hostile in nature when, in fact, they are not; in turn, this maladaptive social information processing is sometimes associated with increased childhood externalizing behaviors (e.g., Dodge, Pettit, Bates, & Valente, 1995). Anger-prone children also may elicit more negative parenting behaviors, which in turn are associated with the development of externalizing behaviors (e.g., Campbell, 1995; Putnam, Sanson, & Rothbart, 2002). First- and second-grade children high in anger were rated as higher in teacher-reported externalizing problems if children viewed their mothers as high in overt hostility (Morris et al., 2002). Lengua (2008) reported that high-frustration children had greater increases in externalizing behaviors across middle childhood within the context of child-reported maternal rejection. Thus, an extensive body of work highlights the association between dysregulated expressions of anger and externalizing behaviors across early development; importantly though, there are important individual (i.e., regulatory abilities) and environmental (i.e., caregiving behaviors) factors that can attenuate or exacerbate this association.

Internalizing Behaviors

Although somewhat counterintuitive, empirical and theoretical work has also indicated that the experience of anger is associated with internalizing difficulties for some children (Eisenberg et al., 2005; Gartstein, Putnam, & Rothbart, 2012; Lemery et al., 2002; Muris, Meesters, & Blijlevens, 2007; Rydell et al., 2003), including symptoms of anxiety and depression, as well as social withdrawal and somatic problems (Achenbach & Edelbrock, 1981). Anger is also proposed to contribute to the etiology of anxiety and depression disorders among adolescents and adults (Leibenluft, Cohen, Gorrindo, Brook, & Pine, 2006; Riley, Treiber, & Woods, 1989). Thus, there is growing evidence that the expression of anger is associated with internalizing symptomatology across the life span. However, this association is inconsistent with some studies finding null effects (e.g., Zahn-Waxler, Cole, Richardson, & Friedman, 1994).

There are multiple pathways that may explain how anger is associated with difficulties within the internalizing realm. Carver and Scheier (1998) proposed that sadness and depression can result from an individual repeatedly failing to approach a goal. As such, individuals might initially experience anger when progress toward a goal is blocked, but after continued efforts to obtain this goal are hindered and presumed lost, the internalizing emotion of sadness may develop. Moreover, given that anger-prone individuals are at risk for experiencing increased social challenges and difficulties (Dougherty, 2006; Eisenberg, Fabes, Bernzweig, & Karbon, 1993; Rydell, Thorell, & Bohlin, 2007), children may experience increased sadness from peer rejection and/or conflict with teachers, thereby leading to internalizing difficulties. Similarly, increases in externalizing behavior problems can coincide with increases in internalizing behavior problems (Gilliom & Shaw, 2004). Therefore, anger may be associated with internalizing difficulties through the risk for developing externalizing behavior problems; indeed, some studies find a strong association between anger proneness and co-occurring internalizing and externalizing behavior problems (e.g., Eisenberg et al., 2009).

Interestingly, whereas most hypotheses regarding the association between anger and internalizing behaviors propose that tendencies toward anger precipitate the development of internalizing behaviors, the opposite may also be true. For instance, because a child with internalizing behaviors may encounter greater social difficulties as she gets older, in turn she may experience increases in anger over time. Or, these children may experience self-directed anger due to feelings of inadequacy. This line of reasoning suggests that the association between anger and internalizing behaviors develops with age (e.g., Eisenberg et al., 2005). Given the lack of empirical work addressing the specific mechanisms and direction of effects regarding the association between anger and internalizing symptomatology, additional work is warranted.

Social Adjustment

Not only is the expression and regulation of anger influenced by social relationships, but it also plays a significant role in the initiation and maintenance of them. There is a rich literature demonstrating that anger-prone children are at a greater risk of social maladjustment, such as lowered social skills, peer relationships, and popularity (Dougherty, 2006; Eisenberg et al., 1993; Ladd & Burgess, 1999; Pianta, Cox, & Snow, 2007; Rydell et al., 2007). For instance, extensive work has focused on the association between anger and children's social skills (i.e., the ability to respond in an appropriate manner in social situations, sharing and cooperating; Gresham & Elliot, 1990; Rose-Krasnor & Denham, 2009). In theory, children with lower expressions of anger, or those who can appropriately regulate their anger, have an easier time acquiring the capacity to use socially skilled behaviors that improve social interactions and benefit others (Rubin, Bukowski, & Parker, 2006); in turn, these children will be better able to utilize their social skills in a variety of situations (Eisenberg, Fabes, & Spinrad, 2006). On the other hand, intense expressions of anger may put children at a social disadvantage by increasing the likelihood that they will be rejected by their peers (Pope, Bierman, & Mumma, 1991), and therefore these children will have fewer opportunities to interact with peers and learn and practice social skills. Empirical evidence supports these hypotheses. For example, easily frustrated toddlers experience more conflicts and are less cooperative with peers (Calkins, Gill, Johnson, & Smith, 1999) and the ability to regulate anger is predictive of preschool and elementary school children's ability to engage in appropriate social skills such as sharing and conflict prevention (Rydell et al., 2003, 2007).

Another commonly studied aspect of social competence, peer group acceptance/rejection, is also associated with children's expressions of anger. As would be expected, children's tendency to express intense negative emotions, especially anger, is associated with being rejected and/or excluded by one's peers from early childhood through adolescence (Eisenberg et al., 1993, 2000; Fabes & Eisenberg, 1992; Kim & Cicchetti, 2010; Szewczyk-Sokolowski, Bost, & Wainwright, 2005; Trentacosta & Shaw, 2009). For example, peer-rejected children expressed more facial and verbal anger than average-status children in the context of losing a game to another child (Hubbard, 2001), and preschool-aged children who were rated as higher in dysregulated negative emotions were more likely to be rejected by their peers (Godleski, Kamper, Ostrov, Hart, & Blakely-McClure, 2015). Indeed, expressions of anger, especially aggressive behavior, are one of the strongest and most consistent behavioral predictors of peer rejection in childhood (Rubin et al., 2006).

There is also growing evidence that anger is associated with peer victimization (Hanish et al., 2004; Jensen-Campbell & Malcolm, 2007; Spence, De Young, Toon, & Bond, 2009), defined as being bullied or aggressed upon repeatedly and over time (Juvonen & Graham, 2014). For example, anger-prone children were more likely to be victimized by peers than other children; interestingly, the display of aggressive behaviors, especially early in the school year, mediated this association for boys (Hanish et al., 2004). In addition, dysregulated negativity (distress, anger/frustration) was associated with more frequent peer victimization both concurrently and across a 6-month period, even after controlling for baseline levels of peer victimization (Rosen, Milich, & Harris, 2012). Thus, extensive empirical evidence highlights that inappropriate expressions of anger are associated with many forms of social maladjustment. Given the significant role that appropriate social competencies play in pathways toward positive adjustment, additional research is warranted to identify processes and mechanisms that may explain these associations.

Academic Adjustment

Another aspect of children's functioning that has been linked to children's anger is difficulties within the academic realm. Although a considerable amount of work has considered the

association between negative emotionality and academic adjustment (Denham et al., 2012; Gumora & Arsenio, 2002), emerging evidence suggests that intense and/or frequent expressions of anger, in particular, are associated with academic difficulties. For instance, teachers' reports of children's anger have been found to be negatively associated with engagement in kindergarten (Valiente, Swanson, & Lemery-Chalfant, 2012), and teachers' reports of Chinese students' anger have been reported as associated with lowered GPA (Zhou, Main, & Wang, 2010).

Various hypotheses have been presented to explain this association. For example, anger may negatively influence students' motivation and enjoyment of school (Pekrun, 2006; Pekrun, Elliot, & Maier, 2009). Thus, children who experience intense anger when dealing with a challenging assignment or don't perform well on a test likely find it more challenging to stay motivated or engaged in school. Anger-prone children also may behave more aggressively with teachers and therefore have lowered social support in the classroom, making school more of a challenge. In addition, anger-prone children may be at a disadvantage in the school setting by way of lowered social abilities. Through lowered development of social skills (Pope & Bierman, 1999; Rydell et al., 2007), anger-prone children likely have fewer supportive peer relationships in the classroom, thus negatively influencing their enthusiasm for school, which would be harmful to their academic competencies. In our own work, we found evidence for this hypothesis (Dollar, Perry, Calkins, Keane, & Shanahan, 2018). Specifically, anger reactivity at age 2 was negatively associated with children's social skills at age 7; in turn, children's social skills were negatively associated with teacher report of academic competence and child and teacher report of school problems at age 10. All three indirect effects were significant suggesting that children's social skills is one mechanism through which toddler anger is associated with academic difficulties. Similarly, anger-prone children may experience academic difficulties through externalizing behaviors. Specifically, externalizing behaviors may limit learning opportunities, as well as increasing the likelihood of being socially rejected or accepted by deviant peers, thereby leading to lowered academic success through a disinterest or expulsion from school (Moilanen, Shaw, & Maxwell, 2010; Schwartz, Gorman, Nakamoto, & McKay, 2006). As can be seen, there is growing evidence to suggest that inappropriate expressions of anger influence academic challenges through various social and psychological mechanisms. In addition, given the well-established link between psychological and physical health, a growing number of studies have considered the role of individual's emotions, including anger, in pathways toward physical health or a lack thereof. Thus, we now turn to a brief review of the literature linking anger and aspects of physical health.

Physical Health

Intense and/or frequent expressions of anger have been linked to aspects of physical well-being, such as substance use/abuse (e.g., Hussong & Cassin, 1994), cardiovascular disease (CVD; e.g., Harburg, Julius, Kaciroti, Gleiberman, & Schork, 2003), cancer (e.g., Thomas et al., 2000), and elevated blood pressure and heart rate (Hauber, Rice, Howell, & Carmon, 1998). Evidence of these associations begin as early as adolescence and continue throughout adulthood. For example, there is growing evidence that the experience of heightened anger is associated with increased adolescent alcohol and substance use (Hussong & Cassin, 1994); interestingly, anger is more strongly related to alcohol and drug use than other negative emotions (McCreary & Sadava, 2000; Pardini, Lochman, & Wells, 2004). Although the exact mechanisms for this association have yet to be determined, one likely pathway is through adolescents' social difficulties. In particular, anger-prone individuals are more likely to associate with deviant peers because they are rejected by their peers (Eisenberg et al., 1993, 2000; Kim & Cicchetti, 2010; Trentacosta & Shaw, 2009), thereby increasing the likelihood that these teens will engage in substance use. Moreover, adolescent dysregulated anger has

been identified as an important correlate of substance use (Colder & Stice, 1998; Cougle, Zvolensky, & Hawkins, 2013), suggesting that anger-prone individuals may engage in substance use/abuse to deal with their intense experience of emotions and possibly social difficulties. In an important preliminary study, Mischel and colleagues (2014) found that the association between dysregulated anger and smoking was explained through individuals' motive to smoke as wanting to reduce the experience of negative emotions. Thus, this growing area of work suggests that, similar to psychological and behavioral difficulties, anger-prone individuals' risk of engaging in substance use can be lessened through the development of appropriate regulatory abilities.

There is also growing evidence of an association between anger and cardiovascular risk (e.g., Gallacher, Yarnell, Sweetnam, Elwood, & Stansfeld, 1999; Kerr, 2008; Kubzansky, Cole, Kawachi, Vokonas, & Sparrow, 2006; Williams, 2010; Williams, Nieto, Sanford, & Tyroler, 2001). Two central hypotheses have been presented to explain the process by which anger is associated with greater CVD (Rozanski, Blumenthal, & Kaplan, 1999). The first explanation involves behavioral and cognitive factors associated with the individual. For instance, an individual that experiences intense feelings of anger may be at a greater risk of developing CVD because he/she engages in poor health behaviors and decisions, such as eating behaviors, exercise, and engagement in substance use/abuse. Or, the association between anger and CVD may be enhanced through cognitive processes, such as rumination, that maintain and increase discomfort, hypertension, and pain (Markovitz, Matthews, Wing, Kuller, & Meilahn, 1991; Miers, Rieffe, Terwogt, Cowan, & Linden, 2007; Schneider, Egan, Johnson, Drobny, & Julius, 1986), such that individuals that experience intense anger are more likely to ruminate about their anger, thereby increasing the likelihood of hypertension, pain, etc. A second explanation suggests a direct physiological mechanism between anger and CVD. Specifically, it has been suggested that hemodynamic and neurohormonal responses of the sympathetic adrenomedullary system and of the hypothalamic pituitary adrenal (HPA) axis may explain the association between anger and CVD. Given these important links between anger and aspects of physical health, additional work is greatly needed to empirically identify the mechanisms, especially early in life, that explain *how* anger is associated with lowered physical health.

Conclusion and Future Directions

In this chapter, we discussed the development of the expression and regulation of anger, in addition to the well-established connection between inappropriate expressions of anger and various maladaptive outcomes. To this end, a biopsychosocial perspective was employed to highlight the importance of the processes associated with children's anger development within the context of families, while also acknowledging the important contribution of underlying biological processes (Calkins, 2011). We primarily considered a functional perspective on emotional development (Barrett & Campos, 1987; Saarni et al., 2006) given its emphasis on how emotions should be considered processes that are dynamic and relational, which is in line with a biopsychosocial perspective. However, it is important to note that many other theoretical perspectives of emotion exist, each providing important, albeit sometimes different, insights into the nature of emotion, including anger. For instance, the differential emotions theory (DET; Izard, 1971) would propose that certain facial expressions reflect anger, whereas other perspectives may contend that the same expression represents a more general negative affective state (e.g., distress) that does not correspond with the discrete emotion of anger (Camras, 1992). There are also differences among emotion theories regarding what is considered an emotional expression (i.e., facial expressions, emotion-related behavioral responses) that significantly influences one's interpretation of the current literature on anger development.

It is also important to note that there are varying perspectives regarding the association

between emotional activation or reactions and emotion regulation. We, along with others (Campos, Frankel, & Camras, 2004; Cole et al., 2004), view emotion processes as regulatory and inherently regulated such that they are not readily distinguishable from one another and cannot be separated from the social context in which they occur. In other words, emotion and its regulation may best be considered unfolding processes rather than discrete occurrences. However, others posit that it is meaningful to be able to account for the way children regulate their emotional responses (Goldsmith, Pollak, & Davidson, 2008; Ochsner & Gross, 2008); therefore, there are aspects of emotional processes that can be specifically labeled as emotion regulation. Importantly, these varying theoretical perspectives of emotion and emotion regulation may promote different interpretations of the existing work on anger development. For instance, a child's facial expression of anger in a frustrating context may be interpreted by some as anger, whereas others may argue that the expression and the corresponding psychophysiological and/or neural activity reflect the child's effort to regulate.

Although the study of anger development has been useful in identifying developmental processes and mechanisms associated with adjustment, many questions remain. Here, we highlight future directions in developmental research that we believe will clarify our understanding of how anger is associated with trajectories of well-being or risk. One important area of future research involves consideration of the similarities and differences between the constructs of anger, frustration, irritability, and aggression, as well as which of these can be considered as an emotion. Some theoretical perspectives, such as DET, consider anger, not frustration, irritability, and aggression, as emotions, whereas other perspectives (e.g., Sroufe, 1996) propose that frustration is a precursor to a more mature emotion of anger. Thus, although many studies on the expression and regulation of anger use the terms "frustration" and "irritability" interchangeably with "anger" as an indicator of emotional functioning, those who subscribe to the DET perspective would argue that frustration and irritability are not, in fact, emotions.

As in many areas of developmental research, semantic and measurement differences make it challenging to synthesize existing empirical work, identify key areas of future inquiries, and inform important prevention and intervention efforts. Moreover, to date, it is not agreed upon if there are qualitative differences between these constructs and if so how they are associated with different developmental trajectories. Similarly, in line with multiple perspectives of emotions (e.g., Izard, 1991), because there are different functions associated with specific negative emotions (i.e., anger, sadness, fear), as well as the fact that they are associated with differing outcomes of interest (e.g., Stifter & Dollar, 2016), we propose that it is important for future work to consider specific negative emotions as opposed to more general measures of negative emotions/emotionality. Answers to these inquiries would greatly clarify work on these associated constructs across the life span.

In addition, too little longitudinal research spans childhood and adolescence, and even fewer studies consider the transitions to and through adulthood. Most research on anger comes from the developmental psychology literature, focused largely on infancy and childhood (although there are a growing number of studies examining adolescence), or the social and personality psychology literature that mainly employs samples of young adults. Thus, there is limited empirical evidence regarding the developmental continuities, processes, and mechanisms associated with the expression and regulation of anger across developmental periods. Although time-consuming and expensive, there is a need for more rigorous longitudinal studies that span multiple developmental periods to fully address the developmental role of anger. Relatedly, it is important for researchers to consider the construct validity and comparison across development when designing and interpreting findings regarding anger. Given the significant differences in normative anger expressions and regulatory abilities across developmental periods, the methodology (i.e., obser-

vational, psychophysiological, self-report, other-report) used is often different across development periods. Moreover, the situations that will elicit the experience, expression, and regulation of anger will vary across development. Thus, while ensuring that measures of anger expressions and regulation are developmentally appropriate, future work spanning developmental periods must consider if, and how, these measures are capturing the same processes at different points in development and, therefore, can be compared across time.

Finally, as can be seen from the reviewed literature, there are significant associations between inappropriate expressions of anger and maladjustment across various realms of functioning. Importantly, emerging evidence suggests that not only are psychological, social, academic, and physical health adjustments important outcomes in their own right, but there are complex, dynamic associations between various realms of adjustment (Bornstein, Hahn, & Haynes, 2010; Pianta & Stuhlman, 2004). For instance, a lack of socially competent behavior may play an underlying role in the emergence of behavior problems across development (Hinshaw, 1992), the development of academic challenges for some children (Pianta & Stuhlman, 2004), and/or engagement in risky health behaviors (Helms et al., 2014; Prinstein, Choukas-Bradley, Helms, Brechwald, & Rancourt, 2011). On the other hand, social abilities may be undermined by psychological and behavioral difficulties, as well as a lack of regulatory abilities, such that children behave inappropriately and have difficulties processing social information, thereby disrupting the development of social skills, positive peer interactions, and healthy friendships (Bornstein et al., 2010). Thus, it is likely that there are reciprocal relations between various realms of adjustment, predicted by early tendencies to experience and express intense anger, and we are just starting to address these transactional relations across development. Future work addressing the specifics of these cross-domain associations not only has implications for developmental theory but may elucidate the etiology of challenges in other realms of functioning.

In sum, we have highlighted how a biopsychosocial perspective may illuminate processes and mechanisms that are important for understanding the etiology and developmental trajectories associated with the experience and expression of anger. Although there are a growing number of studies addressing the transactional nature of children's emotional development, both at the physiological and at the behavioral levels and within the social context, the process by which this development occurs is still largely unknown. For instance, additional work is needed to understand if and how caregivers influence children's development of physiological regulation, as well as how the development of this physiological regulation influences subsequent social interactions with caregivers and peers. We believe that the use of this perspective in future work will encourage researchers to study mechanisms across and between different levels of children's social and emotional functioning, which will greatly aid in understanding how these processes are associated with adjustment or alternatively maladjustment in children who experience and express varying levels of anger. Given the significant, and growing, body of work on the associations between intense, possibly dysregulated expressions of anger and maladjustment across psychological, social, academic, and physical realms, a continued study of *how* and *why* these associations exist will inform preventative interventions, including determining when and how to best intervene.

References

Achenbach, T. M., & Edelbrock, C. S. (1981). Behavioral problems and competencies reported by parents of normal and disturbed children aged four through sixteen. *Monographs of the Society for Research in Child Development, 46*(1), 1–82. https://doi.org/10.2307/1165983

Alessandri, S. M., Sullivan, M. W., & Lewis, M. (1990). Violation of expectancy and frustration in early infancy. *Developmental Psychology, 26*(5), 738–744. https://doi.org/10.1037/0012

Angus, D. J., Kemkes, K., Schutter, D. J. L. G., & Harmon, J. E. (2015). Anger is associated with reward-related electrocortical activity: Evidence from the reward pos-

itivity. *Psychophysiology, 52*(10), 1271–1280. https://doi.org/10.1111/psyp.12460

Barefoot, J. C., Dodge, K. A., Peterson, B. L., Dahlstrom, W. G., & Williams, R. B. (1989). The Cook-Medley hostility scale: Item content and ability to predict survival. *Psychosomatic Medicine, 51*(1), 46–57. https://doi.org/10.1097/00006842-198901000-00005

Barrett, K. C., & Campos, J. J. (1987). Perspectives on emotional development II: A functionalist approach to emotions. In J. D. Osofsky (Ed.), *Handbook of infant development* (pp. 555–578). New York, NY: Guilford Publications, Inc..

Barron, A. P., & Earls, F. (1984). The relation of temperament and social factors to behavior problems in three-year-old children. *Child Psychology & Psychiatry & Allied Disciplines, 25*(1), 23–33. https://doi.org/10.1111/j.1469-7610.1984.tb01716.x

Bates, J. E., Bayles, K., Bennett, D. S., Ridge, B., & Brown, M. M. (1991). Origins of externalizing behavior problems at eight years of age. In D. J. Pepler & K. H. Rubin (Eds.), *The development and treatment of childhood aggression* (pp. 93–120). Hillsdale, NJ: Lawrence Erlbaum Associates.

Bates, J. E., Pettit, G. S., Dodge, K. A., & Ridge, B. (1998). Interaction of temperamental resistance to control and restrictive parenting in the development of externalizing behavior. *Developmental Psychology, 34*(5), 982–995. https://doi.org/10.1037/0012-1649.34.5.982

Bennett, D. S., Bendersky, M., & Lewis, M. (2002). Children's intellectual and emotional-behavioral adjustment at 4 years as a function of cocaine exposure, maternal characteristics, and environmental risk. *Developmental Psychology, 38*(5), 648–658. https://doi.org/10.1037/0012-1649.38.5.648

Bennett, D. S., Bendersky, M., & Lewis, M. (2004). On specifying specificity: Facial expressions at 4 months. *Infancy, 6*(3), 425–429. https://doi.org/10.1207/s15327078in0603_8

Blair, C., & Diamond, A. (2008). Biological processes in prevention and intervention: The promotion of self-regulation as a means of preventing school failure. *Development and Psychopathology, 20*(3), 899–911. https://doi.org/10.1017/S0954579408000436

Bornstein, M. H., Hahn, C., & Haynes, O. (2010). Social competence, externalizing, and internalizing behavioral adjustment from early childhood through early adolescence: Developmental cascades. *Development and Psychopathology, 22*(4), 717–735. https://doi.org/10.1017/S0954579410000416

Bornstein, M. H., & Suess, P. E. (2000). Physiological self-regulation and information processing in infancy: Cardiac vagal tone and habituation. *Child Development, 71*(2), 273–287. https://doi.org/10.1111/1467-8624.00143

Bowlby, J. (1969/1982). *Attachment and loss: Vol. 1. Attachment*. New York, NY: Basic Books.

Braungart-Rieker, J. M., Hill-Soderlund, A. L., & Karrass, J. (2010). Fear and anger reactivity trajectories from 4 to 16 months: The roles of temperament, regulation, and maternal sensitivity. *Developmental Psychology, 46*(4), 791–804. https://doi.org/10.1037/a0019673

Brooker, R. J., Buss, K. A., Lemery-Chalfant, K., Aksan, N., Davidson, R. J., & Goldsmith, H. H. (2014). Profiles of observed infant anger predict preschool behavior problems: Moderation by life stress. *Developmental Psychology, 50*(10), 2343–2352. https://doi.org/10.1037/a0037693

Calkins, S. D. (2011). Caregiving as coregulation: Psychobiological processes and child functioning. In A. Booth, S. M. McHale, & N. S. Lansdale (Eds.), *Biosocial foundations of family processes* (pp. 49–59). New York, NY: Springer Science + Business Media. https://doi.org/10.1007/978-1-4419-7361-0_3

Calkins, S. D., & Dedmon, S. A. (2000). Physiological and behavioral regulation in two-year-old children with aggressive/destructive behavior problems. *Journal of Abnormal Child Psychology, 28*(2), 103–118. https://doi.org/10.1023/A:1005112912906

Calkins, S. D., Dedmon, S. E., Gill, K. L., Lomax, L. E., & Johnson, L. M. (2002). Frustration in infancy: Implications for ER, physiological processes, and temperament. *Infancy, 3*(2), 175–197. https://doi.org/10.1207/S15327078IN0302_4

Calkins, S. D., & Fox, N. A. (2002). Self-regulatory processes in early personality development: A multilevel approach to the study of childhood social withdrawal and aggression. *Development and Psychopathology, 14*(3), 477–498. https://doi.org/10.1017/S095457940200305X

Calkins, S. D., Gill, K. L., Johnson, M. C., & Smith, C. L. (1999). Emotional reactivity and emotional regulation strategies as predictors of social behavior with peers during toddlerhood. *Social Development, 8*(3), 310–334. https://doi.org/10.1111/1467-9507.00098

Calkins, S. D., Graziano, P. A., & Keane, S. P. (2007). Cardiac vagal regulation differentiates among children at risk for behavior problems. *Biological Psychology, 74*(2), 144–153. https://doi.org/10.1016/j.biopsycho.2006.09.005

Calkins, S. D., & Leerkes, E. M. (2011). Attachment processes and the development of emotional self-regulation. In K. D. Vohs & R. F. Baumeister (Eds.), *Handbook of self-regulation: Research, theory, and applications* (2nd ed., pp. 355–373). New York, NY: Guilford Press.

Calkins, S. D., Perry, N. B., & Dollar, J. M. (2016). A biopsychosocial model of the development of self-regulation in infancy. In L. Balter & C. S. Tamis-LeMonda (Eds.), *Child psychology: A handbook of contemporary issues* (3rd ed., pp. 3–22). New York, NY: Routledge.

Calkins, S. D., Smith, C. L., Gill, K. L., & Johnson, M. C. (1998). Maternal interactive style across contexts: Relations to emotional, behavioral and physiological regulation during toddlerhood. *Social Development, 7*(3), 350–369. https://doi.org/10.1111/1467-9507.00072

Campbell, S. B. (1990). *Behavior problems in preschool children: Clinical and developmental issues*. New York, NY: Guilford Press.

Campbell, S. B. (1995). Behavior problems in preschool children: A review of recent research. *Child*

Psychology & Psychiatry & Allied Disciplines, 36(1), 113–149. https://doi.org/10.1111/j.1469-7610.1995.tb01657.x

Campbell, S. B. (2002). *Behavior problems in preschool children: Clinical and developmental issues* (2nd ed.). New York, NY: Guilford Press.

Campbell, S. B., Shaw, D. S., & Gilliom, M. (2000). Early externalizing behavior problems: Toddlers and preschoolers at risk for later maladjustment. *Development and Psychopathology, 12*, 467–488. https://doi.org/10.1017/S0954579400003114

Campbell, S. B., Spieker, S., Vandergrift, N., Belsky, J., & Burchinal, M. (2010). Predictors and sequelae of trajectories of physical aggression in school-age boys and girls. *Development and Psychopathology, 22*(1), 133–150. https://doi.org/10.1017/S0954579409990319

Campos, J. J., Frankel, C. B., & Camras, L. (2004). On the nature of emotion regulation. *Child Development, 75*, 377–394.

Camras, L. A. (1992). Expressive development and basic emotions. *Cognition and Emotion, 6*(3–4), 269–283. https://doi.org/10.1080/02699939208411072

Camras, L. A. (2004). An event-emotion or event-expression hypothesis? A comment on the commentaries on Bennett, Bendersky, & Lewis (2002). *Infancy, 6*(3), 431–433. https://doi.org/10.1207/s15327078in0603_9

Carver, C. S., & Harmon-Jones, E. (2009). Anger is an approach-related affect: Evidence and implications. *Psychological Bulletin, 135*(2), 183–204. https://doi.org/10.1037/a0013965

Carver, C. S., & Scheier, M. F. (1998). *On the self-regulation of behavior*. New York, NY: Cambridge University Press. https://doi.org/10.1017/CBO9781139174794

Casey, B. J., & Caudle, K. (2013). The teenage brain: Self-control. *Current Directions in Psychological Science, 22*(2), 82–87. https://doi.org/10.1177/0963721413480170

Casey, R. J., & Schlosser, S. (1994). Emotional responses to peer praise in children with and without a diagnosed externalizing disorder. *Merrill-Palmer Quarterly, 40*(1), 60–81.

Colder, C. R., & Stice, E. (1998). A longitudinal study of the interactive effects of impulsivity and anger on adolescent problem behavior. *Journal of Youth and Adolescence, 27*(3), 255–274. https://doi.org/10.1023/A:1022889202419

Cole, P. M., Armstrong, L. M., & Pemberton, C. K. (2010). The role of language in the development of emotion regulation. In S. D. Calkins & M. A. Bell (Eds.), *Child development at the intersection of emotion and cognition* (pp. 59–77). Washington, DC: American Psychological Association. https://doi.org/10.1037/12059-004

Cole, P. M., Martin, S. E., & Dennis, T. A. (2004). Emotion regulation as a scientific construct: Methodological challenges and directions for child development research. *Child Development, 75*(2), 317–333. https://doi.org/10.1111/j.1467-8624.2004.00673.x

Cole, P. M., Michel, M. K., & Teti, L. O. (1994). The development of emotion regulation and dysregulation: A clinical perspective. *Monographs of the Society for Research in Child Development, 59*(2/3), 73–100. https://doi.org/10.2307/1166139

Cole, P. M., Tan, P. Z., Hall, S. E., Zhang, Y., Crnic, K. A., Blair, C. B., & Li, R. (2011). Developmental changes in anger expression and attention focus: Learning to wait. *Developmental Psychology, 47*(4), 1078–1089. https://doi.org/10.1037/a0023813

Cole, P. M., Teti, L. O., & Zahn-Waxler, C. (2003). Mutual emotion regulation and the stability of conduct problems between preschool and early school age. *Development and Psychopathology, 15*(1), 1–18. https://doi.org/10.1017/S0954579403000014

Cole, P. M., Zahn-Waxler, C., & Smith, K. D. (1994). Expressive control during a disappointment: Variations related to preschoolers' behavior problems. *Developmental Psychology, 30*(6), 835–846. https://doi.org/10.1037/0012-1649.30.6.835

Comings, D. E., Gade-Andavolu, R., Gonzalez, N., Wu, S., Muhleman, D., Blake, H., … Macmurray, J. P. (2000). Multivariate analysis of associations of 42 genes in ADHD, ODD and conduct disorder. *Clinical Genetics, 58*(1), 31–40. https://doi.org/10.1034/j.1399-0004.2000.580106.x

Cougle, J. R., Zvolensky, M. J., & Hawkins, K. A. (2013). Delineating a relationship between problematic anger and cigarette smoking: A population-based study. *Nicotine & Tobacco Research, 15*(1), 297–301. https://doi.org/10.1093/ntr/nts122

Deater-Deckard, K., Beekman, C., Wang, Z., Kim, J., Petrill, S., Thompson, L., & DeThorne, L. (2010). Approach/positive anticipation, frustration/anger, and overt aggression in childhood. *Journal of Personality, 78*(3), 991–1010. https://doi.org/10.1111/j.1467-6494.2010.00640.x

Deater-Deckard, K., Petrill, S. A., & Thompson, L. A. (2007). Anger/frustration, task persistence, and conduct problems in childhood: A behavioral genetic analysis. *Journal of Child Psychology and Psychiatry, 48*(1), 80–87. https://doi.org/10.1111/j.1469-7610.2006.01653.x

Degnan, K. A., Calkins, S. D., Keane, S. P., & Hill-Soderlund, A. L. (2008). Profiles of disruptive behavior across early childhood: Contributions of frustration reactivity, physiological regulation, and maternal behavior. *Child Development, 79*(5), 1357–1376. https://doi.org/10.1111/j.1467-8624.2008.01193.x

Denham, S. A. (1998). *Emotional development in young children*. New York, NY: Guilford Press.

Denham, S. A., Bassett, H. H., Thayer, S. K., Mincic, M. S., Sirotkin, Y. S., & Zinsser, K. (2012). Observing preschoolers' social-emotional behavior: Structure, foundations, and prediction of early school success. *The Journal of Genetic Psychology: Research and Theory on Human Development, 173*(3), 246–278. https://doi.org/10.1080/00221325.2011.597457

Denham, S. A., Bassett, H. H., & Wyatt, T. (2007). The socialization of emotional competence. In J. E. Grusec, P. D. Hastings, J. E. Grusec, & P. D. Hastings (Eds.),

Handbook of socialization: Theory and research (pp. 614–637). New York, NY: Guilford Press.

Denham, S. A., Caverly, S., Schmidt, M., Blair, K., DeMulder, E., Caal, S., … Mason, T. (2002). Preschool understanding of emotions: Contributions to classroom anger and aggression. *Journal of Child Psychology and Psychiatry, 43*(7), 901–916. https://doi.org/10.1111/1469-7610.00139

Denham, S. A., Lehman, E. B., Moser, M. H., & Reeves, S. L. (1995). Continuity and change in emotional components of infant temperament. *Child Study Journal, 25*(4), 289–308.

Denham, S. A., Mitchell-Copeland, J., Strandberg, K., Auerbach, S., & Blair, K. (1997). Parental contributions to preschoolers' emotional competence: Direct and indirect effects. *Motivation and Emotion, 21*(1), 65–86. https://doi.org/10.1023/A:1024426431247

Denson, T. F., Pedersen, W. C., Ronquillo, J., & Nandy, A. S. (2009). The angry brain: Neural correlates of anger, angry rumination, and aggressive personality. *Journal of Cognitive Neuroscience, 21*(4), 734–744. https://doi.org/10.1162/jocn.2009.21051

Depue, R. A., & Lacono, W. G. (1989). Neurobehavioral aspects of affective disorders. *Annual Review of Psychology, 40*, 457–492. https://doi.org/10.1146/annurev.ps.40.020189.002325

Derryberry, D., & Rothbart, M. K. (1997). Reactive and effortful processes in the organization of temperament. *Development and Psychopathology, 9*(4), 633–652. https://doi.org/10.1017/S0954579497001375

Dodge, K. A., Pettit, G. S., Bates, J. E., & Valente, E. (1995). Social information-processing patterns partially mediate the effect of early physical abuse on later conduct problems. *Journal of Abnormal Psychology, 104*(4), 632–643. https://doi.org/10.1037/0021-843X.104.4.632

Dollar, J. M., Perry, N. B., Calkins, S. D., Keane, S. P., & Shanahan, L. (2018). Temperamental anger and the development of social skills: Implications for academic competence during preadolescence. *Early Education and Development*. https://doi.org/10.1080/10409289.2017.1409606

Dougherty, L. R. (2006). Children's emotionality and social status: A meta-analytic review. *Social Development, 15*(3), 394–417. https://doi.org/10.1111/j.1467-9507.2006.00348.x

Eisenberg, N., Cumberland, A., & Spinrad, T. L. (1998). Parental socialization of emotion. *Psychological Inquiry, 9*(4), 241–273. https://doi.org/10.1207/s15327965pli0904_1

Eisenberg, N., Cumberland, A., Spinrad, T. L., Fabes, R. A., Shepart, S. A., Reiser, M., … Guthrie, I. K. (2001). The relations of regulation and emotionality to children's externalizing and internalizing problem behavior. *Child Development, 72*(4), 1112–1134. https://doi.org/10.1111/1467-8624.00337

Eisenberg, N., Fabes, R. A., Bernzweig, J., & Karbon, M. (1993). The relations of emotionality and regulation to preschoolers' social skills and sociometric status. *Child Development, 64*(5), 1418–1438. https://doi.org/10.2307/1131543

Eisenberg, N., Fabes, R. A., Nyman, M., Bernzweig, J., & Pinuelas, A. (1994). The relations of emotionality and regulation to children's anger-related reactions. *Child Development, 65*(1), 109–128. https://doi.org/10.2307/1131369

Eisenberg, N., Fabes, R. A., Murphy, B., Maszk, P., Smith, M., & Karbon, M. (1995). The role of emotionality and regulation in children's social functioning: A longitudinal study. *Child Development, 66*(5), 1360–1384. https://doi.org/10.2307/1131652

Eisenberg, N., Fabes, R. A., & Murphy, B. C. (1996). Parents' reactions to children's negative emotions: Relations to children's social competence and comforting behavior. *Child Development, 67*(5), 2227–2247. https://doi.org/10.2307/1131620

Eisenberg, N., Fabes, R. A., & Spinrad, T. L. (2006). Prosocial development. In N. Eisenberg, W. Damon, & R. M. Lerner (Eds.), *Handbook of child psychology: Vol. 3, Social, emotional, and personality development* (6th ed., pp. 646–718). Hoboken, NJ: Wiley.

Eisenberg, N., Guthrie, I. K., Fabes, R. A., Shepard, S., Losoya, S., Murphy, B. C., … Reiser, M. (2000). Prediction of elementary school children's externalizing problem behaviors from attentional and behavioral regulation and negative emotionality. *Child Development, 71*(5), 1367–1382. https://doi.org/10.1111/1467-8624.00233

Eisenberg, N., Ma, Y., Chang, L., Zhou, Q., West, S. G., & Aiken, L. (2007). Relations of effortful control, reactive undercontrol, and anger to Chinese children's adjustment. *Development and Psychopathology, 19*(2), 385–409. https://doi.org/10.1017/S0954579407070198

Eisenberg, N., Sadovsky, A., Spinrad, T. L., Fabes, R. A., Losoya, S. H., Valiente, C., … Shepard, S. A. (2005). The relations of problem behavior status to children's negative emotionality, effortful control, and impulsivity: Concurrent relations and prediction of change. *Developmental Psychology, 41*(1), 193–211. https://doi.org/10.1037/0012-1649.41.1.193

Eisenberg, N., Valiente, C., Spinrad, T. L., Cumberland, A., Liew, J., Reiser, M., … Losoya, S. H. (2009). Longitudinal relations of children's effortful control, impulsivity, and negative emotionality to their externalizing, internalizing, and co-occurring behavior problems. *Developmental Psychology, 45*(4), 988–1008. https://doi.org/10.1037/a0016213

Fabes, R. A., & Eisenberg, N. (1992). Young children's coping with interpersonal anger. *Child Development, 63*(1), 116–128. https://doi.org/10.2307/1130906

Fergusson, D. M., Lynskey, M. T., & Horwood, L. J. (1996). Factors associated with continuity and changes in disruptive behavior patterns between childhood and adolescence. *Journal of Abnormal Child Psychology, 24*(5), 533–553. https://doi.org/10.1007/BF01670099

Fonzi, S., Schneider, B. H., Tani, F., & Tomada, G. (1997). Predicting children's friendship status from their dyadic interaction in structured situations of potential conflict. *Child Development, 68*(3), 496–506. https://doi.org/10.2307/1131674

Fox, N. A. (1989). Infant response to frustrating and mildly stressful events: A positive look at anger in the first year. *New Directions for Child Development, 45*, 47–64. https://doi.org/10.1002/cd.23219894506

Frijda, N. H. (1986). *The emotions*. Cambridge, UK: Cambridge University Press.

Gagne, J. R., & Goldsmith, H. H. (2011). A longitudinal analysis of anger and inhibitory control in twins from 12 to 36 months of age. *Developmental Science, 14*(1), 112–124. https://doi.org/10.1111/j.1467-7687.2010.00969.x

Gallacher, J. E., Yarnell, J. G., Sweetnam, P. M., Elwood, P. C., & Stansfeld, S. A. (1999). Anger and incident heart disease in the Caerphilly study. *Psychosomatic Medicine, 61*(4), 446–453. https://doi.org/10.1097/00006842-199907000-00007

Gartstein, M. A., Putnam, S. P., & Rothbart, M. K. (2012). Etiology of preschool behavior problems: Contributions of temperament attributes in early childhood. *Infant Mental Health Journal, 33*(2), 197–211. https://doi.org/10.1002/imhj.21312

Gilliom, M., & Shaw, D. S. (2004). Codevelopment of externalizing and internalizing problems in early childhood. *Development and Psychopathology, 16*(2), 313–333. https://doi.org/10.1017/S0954579404044530

Gilliom, M., Shaw, D. S., Beck, J. E., Schonberg, M. A., & Lukon, J. L. (2002). Anger regulation in disadvantaged preschool boys: Strategies, antecedents, and the development of self-control. *Developmental Psychology, 38*(2), 222–235. https://doi.org/10.1037/0012-1649.38.2.222

Godleski, S. A., Kamper, K. E., Ostrov, J. M., Hart, E. J., & Blakely-McClure, S. J. (2015). Peer victimization and peer rejection during early childhood. *Journal of Clinical Child and Adolescent Psychology, 44*(3), 380–392. https://doi.org/10.1080/15374416.2014.940622

Goldsmith, H. H., Buss, K. A., & Lemery, K. S. (1997). Toddler and childhood temperament: Expanded content, stronger genetic evidence, new evidence for the importance of environment. *Developmental Psychology, 33*(6), 891–905. https://doi.org/10.1037/0012-1649.33.6.891

Goldsmith, H. H., Pollak, S. D., & Davidson, R. J. (2008). Developmental neuroscience perspectives on emotion regulation. *Child Development Perspectives, 2*, 132–140.

Gottman, J. M., Katz, L. F., & Hooven, C. (1996). Parental meta-emotion philosophy and the emotional life of families: Theoretical models and preliminary data. *Journal of Family Psychology, 10*(3), 243–268. https://doi.org/10.1037/0893-3200.10.3.243

Gottman, J. M., Katz, L. F., & Hooven, C. (1997). *Meta-emotion: How families communicate emotionally*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Grandjean, D., Sander, D., Pourtois, G., Schwartz, S., Seghier, M. L., Scherer, K. R., & Vuilleumier, P. (2005). The voices of wrath: Brain responses to angry prosody in meaningless speech. *Nature Neuroscience, 8*(2), 145–146. https://doi.org/10.1038/nn1392

Graziano, P., & Derefinko, K. (2013). Cardiac vagal control and children's adaptive functioning: A meta-analysis. *Biological Psychology, 94*(1), 22–37. https://doi.org/10.1016/j.biopsycho.2013.04.011

Gresham, F. M., & Elliot, S. N. (1990). *Social skills rating system manual*. Circle Pines, MN: American Guidance Service.

Gumora, G., & Arsenio, W. F. (2002). Emotionality, emotion regulation, and school performance in middle school children. *Journal of School Psychology, 40*(5), 395–413. https://doi.org/10.1016/S0022-4405(02)00108-5

Hanish, L. D., Kochenderfer-Ladd, B., Fabes, R. A., Martin, C. L., & Denning, D. (2004). Bullying among young children: The influence of peers and teachers. In D. L. Espelage, S. M. Swearer, D. L. Espelage, & S. M. Swearer (Eds.), *Bullying in American schools: A social-ecological perspective on prevention and intervention* (pp. 141–159). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Harburg, E., Julius, M., Kaciroti, N., Gleiberman, L., & Schork, M. A. (2003). Expressive/suppressive anger-coping responses, gender, and types of mortality: A 17-year follow-up (Tecumseh, Michigan, 1971–1988). *Psychosomatic Medicine, 65*(4), 588–597. https://doi.org/10.1097/01.PSY.0000075974.19706.3B

Harmon-Jones, E. (2004). Contributions from research on anger and cognitive dissonance to understanding the motivational functions of asymmetrical frontal brain activity. *Biological Psychology, 67*(1–2), 51–76. https://doi.org/10.1016/j.biopsycho.2004.03.003

Harmon-Jones, E. (2007). Trait anger predicts relative left frontal cortical activation to anger-inducing stimuli. *International Journal of Psychophysiology, 66*(2), 154–160. https://doi.org/10.1016/j.ijpsycho.2007.03.020

Harmon-Jones, E., & Allen, J. B. (1998). Anger and frontal brain activity: EEG asymmetry consistent with approach motivation despite negative affective valence. *Journal of Personality and Social Psychology, 74*(5), 1310–1316. https://doi.org/10.1037/0022-3514.74.5.1310

Harmon-Jones, E., Harmon-Jones, C., Abramson, L., & Peterson, C. K. (2009). PANAS positive activation is associated with anger. *Emotion, 9*(2), 183–196. https://doi.org/10.1037/a0014959

Harmon-Jones, E., & Sigelman, J. (2001). State anger and prefrontal brain activity: Evidence that insult-related relative left-prefrontal activation is associated with experienced anger and aggression. *Journal of Personality and Social Psychology, 80*(5), 797–803. https://doi.org/10.1037/0022-3514.80.5.797

Hartup, W. W. (1974). Aggression in childhood: Developmental perspectives. *American Psychologist, 29*(5), 336–341. https://doi.org/10.1037/h0037622

Hauber, R. P., Rice, M. H., Howell, C. C., & Carmon, M. (1998). Anger and blood pressure readings in children. *Applied Nursing Research, 11*(1), 2–11. https://doi.org/10.1016/S0897-1897(98)80021-9

He, J., Xu, Q., & Degnan, K. A. (2012). Anger expression and persistence in young children.

Social Development, 21(2), 343–353. https://doi.org/10.1111/j.1467-9507.2011.00622.x

Helms, S. W., Choukas-Bradley, S., Widman, L., Giletta, M., Cohen, G. L., & Prinstein, M. J. (2014). Adolescents misperceive and are influenced by high-status peers' health risk, deviant, and adaptive behavior. *Developmental Psychology, 50*(12), 2697–2714. https://doi.org/10.1037/a0038178

Hernández, M. M., Eisenberg, N., Valiente, C., Spinrad, T. L., VanSchyndel, S. K., Diaz, A., … Piña, A. A. (2015). Observed emotion frequency versus intensity as predictors of socioemotional maladjustment. *Emotion, 15*(6), 699–704. https://doi.org/10.1037/emo0000099

Hinshaw, S. P. (1992). Externalizing behavior problems and academic underachievement in childhood and adolescence: Causal relationships and underlying mechanisms. *Psychological Bulletin, 111*(1), 127–155. https://doi.org/10.1037/0033-2909.111.1.127

Hostinar, C. E., & Gunnar, M. R. (2013). The developmental psychobiology of stress and emotion in childhood. In R. M. Lerner, M. A. Easterbrooks, J. Mistry, I. B. Weiner, R. M. Lerner, M. A. Easterbrooks, et al. (Eds.), *Handbook of psychology: Developmental psychology* (pp. 121–141). Hoboken, NJ: Wiley.

Hubbard, J. A. (2001). Emotion expression processes in children's peer interaction: The role of peer rejection, aggression, and gender. *Child Development, 72*(5), 1426–1438. https://doi.org/10.1111/1467-8624.00357

Hussong, A. M., & Cassin, L. (1994). The stress-negative affect model of adolescent alcohol use: Disaggregating negative affect. *Journal of Studies on Alcohol, 55*(6), 707–718. https://doi.org/10.15288/jsa.1994.55.707

Izard, C. E. (1971). *The face of emotion*. East Norwalk, CT: Appleton-Century-Crofts.

Izard, C. E. (1977). *Human emotions*. New York, NY: Plenum.

Izard, C. E. (1991). *The psychology of emotions*. New York, NY: Plenum Press.

Izard, C. E. (2004). The generality-specificity issue in infants' emotion responses: A comment on Bennett, Bendersky, and Lewis (2002). *Infancy, 6*(3), 417–423. https://doi.org/10.1207/s15327078in0603_7

Jensen-Campbell, L. A., & Malcolm, K. T. (2007). The importance of conscientiousness in adolescent interpersonal relationships. *Personality and Social Psychology Bulletin, 33*(3), 368–383. https://doi.org/10.1177/0146167206296104

Juvonen, J., & Graham, S. (2014). Bullying in schools: The power of bullies and the plight of victims. *Annual Review of Psychology, 65*, 159–185. https://doi.org/10.1146/annurev-psych-010213-115030

Kalpidou, M. D., Power, T. G., Cherry, K. E., & Gottfried, N. W. (2004). Regulation of emotion and behavior among 3- and 5-year-olds. *Journal of General Psychology, 131*(2), 159–178. https://doi.org/10.3200/GENP.131.2.159-180

Keenan, K. (2000). Emotion dysregulation as a risk factor for child psychopathology. *Clinical Psychology: Science and Practice, 7*(4), 418–434. https://doi.org/10.1093/clipsy/7.4.418

Kerr, J. H. (2008). A critique of the development of the competitive aggressiveness and anger scale. *Psychology of Sport and Exercise, 9*(6), 721–728. https://doi.org/10.1016/j.psychsport.2008.01.001

Kim, J., & Cicchetti, D. (2010). Longitudinal pathways linking child maltreatment, emotion regulation, peer relations, and psychopathology. *Journal of Child Psychology and Psychiatry, 51*(6), 706–716. https://doi.org/10.1111/j.1469-7610.2009.02202.x

Kim, J., Deater-Deckard, K., Mullineaux, P. Y., & Allen, B. (2010). Longitudinal studies of anger and attention span: Context and informant effects. *Journal of Personality, 78*(2), 419–440. https://doi.org/10.1111/j.1467-6494.2010.00621.x

Kochanska, G., Coy, K. C., Tjebkes, T. L., & Husarek, S. J. (1998). Individual differences in emotionality in infancy. *Child Development, 69*(2), 375–390. https://doi.org/10.2307/1132172

Kochanska, G., & Kim, S. (2012). Toward a new understanding of legacy of early attachments for future antisocial trajectories: Evidence from two longitudinal studies. *Development and Psychopathology, 24*(3), 783–806. https://doi.org/10.1017/S0954579412000375

Kopp, C. (1982). Antecedents of self-regulation: A developmental perspective. *Developmental Psychology, 18*(2), 199–214. https://doi.org/10.1037/0012-1649.18.2.199

Kopp, C. (1989). Regulation of distress and negative emotions: A developmental view. *Developmental Psychology, 25*(3), 243–254. https://doi.org/10.1037/0012-1649.25.3.343

Kubzansky, L. D., Cole, S. R., Kawachi, I., Vokonas, P., & Sparrow, D. (2006). Shared and unique contributions of anger, anxiety, and depression to coronary heart disease: A prospective study in the normative aging study. *Annals of Behavioral Medicine, 31*(1), 21–29. https://doi.org/10.1207/s15324796abm3101_5

Ladd, G. W., & Burgess, K. B. (1999). Charting the relationship trajectories of aggressive, withdrawn, and aggressive/withdrawn children during early grade school. *Child Development, 70*(4), 910–929. https://doi.org/10.1111/1467-8624.00066

Larson, R., & Asmussen, L. (1991). Anger, worry, and hurt in early adolescence: An enlarging world of negative emotions. In M. E. Colten, S. Gore, M. E. Colten, & S. Gore (Eds.), *Adolescent stress: Causes and consequences* (pp. 21–41). Hawthorne, NY: Aldine de Gruyter.

Laursen, B., Finkelstein, B. D., & Betts, N. T. (2001). A developmental meta-analysis of peer conflict resolution. *Developmental Review, 21*, 423–449. https://doi.org/10.1006/drev.2000.0531

Leibenluft, E., Cohen, P., Gorrindo, T., Brook, J. S., & Pine, D. S. (2006). Chronic versus episodic irritability in youth: A community-based, longitudinal study of clinical and diagnostic associations. *Journal of Child*

and Adolescent Psychopharmacology, 16(4), 456–466. https://doi.org/10.1089/cap.2006.16.456

Lemerise, E. A., & Dodge, K. A. (2008). The development of anger and hostile interactions. In M. Lewis, J. M. Haviland-Jones, L. F. Barrett, M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 730–741). New York, NY: Guilford Press.

Lemery, K. S., Essex, M. J., & Smider, N. A. (2002). Revealing the relation between temperament and behavior problem symptoms by eliminating measurement confounding: Expert ratings and factor analyses. *Child Development, 73*(3), 867–882. https://doi.org/10.1111/1467-8624.00444

Lengua, L. J. (2006). Growth in temperament and parenting as predictors of adjustment during children's transition to adolescence. *Developmental Psychology, 42*(5), 819–832. https://doi.org/10.1037/0012-1649.42.5.819

Lengua, L. J. (2008). Anxiousness, frustration, and effortful control as moderators of the relation between parenting and adjustment in middle-childhood. *Social Development, 17*(3), 554–577. https://doi.org/10.1111/j.1467-9507.2007.00438.x

Lengua, L. J., & Wachs, T. D. (2012). Temperament and risk: Resilient and vulnerable responses to adversity. In M. Zentner, R. L. Shiner, M. Zentner, & R. L. Shiner (Eds.), *Handbook of temperament* (pp. 519–540). New York, NY: Guilford Press.

Lewis, M., Alessandri, S. M., & Sullivan, M. W. (1990). Violation of expectancy, loss of control, and anger expressions in young infants. *Developmental Psychology, 26*(5), 745–751. https://doi.org/10.1037/0012-1649.26.5.745

Lewis, M., & Ramsay, D. (2005). Infant emotional and cortisol responses to goal blockage. *Child Development, 76*(2), 518–530. https://doi.org/10.1111/j.1467-8624.2005.00860.x

Lewis, M., Ramsay, D. S., & Kawakami, K. (1993). Differences between Japanese infants and Caucasian American infants in behavioral and cortisol response to inoculation. *Child Development, 64*(6), 1722–1731. https://doi.org/10.1111/j.1467-8624.1993.tb04209.x

Lewis, M., Ramsay, D. S., & Sullivan, M. W. (2006). The relation of ANS and HPA activation to infant anger and sadness response to goal blockage. *Developmental Psychobiology, 48*(5), 397–405. https://doi.org/10.1002/dev.20151

Lewis, M., Sullivan, M. W., Ramsay, D. S., & Alessandri, S. M. (1992). Individual differences in anger and sad expressions during extinction: Antecedents and consequences. *Infant Behavior & Development, 15*(4), 443–452. https://doi.org/10.1016/0163-6383(92)80012-J

Loeber, R., Farrington, D. P., Stouthamer-Loeber, M., Moffitt, T. E., & Caspi, A. (1998). The development of male offending: Key findings from the first decade of the Pittsburgh Youth Study. *Studies on Crime & Crime Prevention, 7*(2), 141–171.

Markovitz, J. H., Matthews, K. A., Wing, R. R., Kuller, L. H., & Meilahn, E. N. (1991). Psychological, biological and health behavior predictors of blood pressure changes in middle-aged women. *Journal of Hypertension, 9*(5), 399–406. https://doi.org/10.1001/jama.1993.03510200045030

McCreary, D. R., & Sadava, S. W. (2000). Stress, alcohol use and alcohol-related problems: The influence of negative and positive affect in two cohorts of young adults. *Journal of Studies on Alcohol, 61*(3), 466–474. https://doi.org/10.15288/jsa.2000.61.466

Miers, A. C., Rieffe, C., Terwogt, M. M., Cowan, R., & Linden, W. (2007). The relation between anger coping strategies, anger mood and somatic complaints in children and adolescents. *Journal of Abnormal Child Psychology, 35*(4), 653–664. https://doi.org/10.1007/s10802-007-9120-9

Mischel, E. R., Leen-Feldner, E. W., Knapp, A. A., Bilsky, S. A., Ham, L., & Lewis, S. (2014). Indirect effects of smoking motives on adolescent anger dysregulation and smoking. *Addictive Behaviors, 39*(12), 1831–1838. https://doi.org/10.1016/j.addbeh.2014.07.029

Moilanen, K. L. (2007). The adolescent self-regulatory inventory: The development and validation of a questionnaire of short-term and long-term self-regulation. *Journal of Youth and Adolescence, 36*(6), 835–848. https://doi.org/10.1007/s10964-006-9107-9

Moilanen, K. L., Shaw, D. S., & Maxwell, K. L. (2010). Developmental cascades: Externalizing, internalizing and academic competence from middle childhood to early adolescence. *Development and Psychopathology, 22*(3), 635–653. https://doi.org/10.1017/S0954579410000337

Moran, L. R., Lengua, L. J., & Zalewski, M. (2013). The interaction between negative emotionality and effortful control in early social-emotional development. *Social Development, 22*(2), 340–362. https://doi.org/10.1111/sode.12025

Morris, A., Silk, J., Steinberg, L., Myers, S., & Robinson, L. (2007). The role of the family context in the development of emotion regulation. *Social Development, 16*(2), 361–388. https://doi.org/10.1111/j.1467-9507.2007.00389.x

Morris, A. S., Silk, J. S., Steinberg, L., Sessa, F. M., Avenevoli, S., & Essex, M. J. (2002). Temperamental vulnerability and negative parenting as interacting predictors of child adjustment. *Journal of Marriage and Family, 64*(2), 461471. https://doi.org/10.1111/j.1741-3737.2002.00461.x

Muris, P., Meesters, C., & Blijlevens, P. (2007). Self-reported reactive and regulative temperament in early adolescence: Relations to internalizing and externalizing problem behavior and 'Big Three' personality factors. *Journal of Adolescence, 30*(6), 1035–1049. https://doi.org/10.1016/j.adolescence.2007.03.003

NICHD ECCRN. (2004). Affect dysregulation in the mother-child relationship in the toddler years: Antecedents and consequences. *Development and Psychopathology, 16*(1), 43–68. https://doi.org/10.1017/S0954579404044402

Nozadi, S. S., Spinrad, T. L., Eisenberg, N., & Eggum-Wilkens, N. D. (2015). Associations of anger and fear to later self-regulation and problem behav-

ior symptoms. *Journal of Applied Developmental Psychology, 38*(8), 60–69. https://doi.org/10.1016/j.appdev.2015.04.005

Ochsner, K. N., & Gross, J. J. (2008). Cognitive emotion regulation: Insights from social cognitive and affective neuroscience. *Current Directions in Psychological Science, 17*, 153–158.

Oster, H. (2005). The repertoire of infant facial expressions: An ontogenetic perspective. In J. Nadel, D. Muir, J. Nadel, & D. Muir (Eds.), *Emotional development: Recent research advances* (pp. 261–292). New York, NY: Oxford University Press.

Pardini, D., Lochman, J., & Wells, K. (2004). Negative emotions and alcohol use initiation in high-risk boys: The moderating effect of good inhibitory control. *Journal of Abnormal Child Psychology, 32*(5), 505–518. https://doi.org/10.1023/B:JACP.0000037780.22849.23

Parker, J. G., & Gottman, J. M. (1989). Social and emotional development in a relational context: Friendship interaction from early childhood to adolescence. In T. J. Berndt, G. W. Ladd, T. J. Berndt, & G. W. Ladd (Eds.), *Peer relationships in child development* (pp. 95–131). Oxford, UK: Wiley.

Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review, 18*(4), 315–341. https://doi.org/10.1007/s10648-006-9029-9

Pekrun, R., Elliot, A. J., & Maier, M. A. (2009). Achievement goals and achievement emotions: Testing a model of their joint relations with academic performance. *Journal of Educational Psychology, 101*(1), 115–135. https://doi.org/10.1037/a0013383

Perry, N. B., Calkins, S. D., Dollar, J. M., Keane, S. P., & Shanahan, L. (2017). Self-regulation as a predictor of patterns of change in externalizing behaviors from infancy to adolescence. *Development and Psychopathology*. https://doi.org/10.1017/S0954579417000992

Pianta, R. C., Cox, M. J., & Snow, K. L. (2007). *School readiness and the transition to kindergarten in the era of accountability*. Baltimore, MD: Paul H Brookes Publishing.

Pianta, R. C., & Stuhlman, M. W. (2004). Teacher-child relationships and children's success in the first years of school. *School Psychology Review, 33*(3), 444–458.

Pickles, A., Hill, J., Breen, G., Quinn, J., Abbott, K., Jones, H., & Sharp, H. (2013). Evidence for interplay between genes and parenting on infant temperament in the first year of life: Monoamine oxidase A polymorphism moderates effects of maternal sensitivity on infant anger proneness. *Journal of Child Psychology and Psychiatry, 54*(12), 1308–1317. https://doi.org/10.1111/jcpp.12081

Pope, A. W., & Bierman, K. L. (1999). Predicting adolescent peer problems and antisocial activities: The relative roles of aggression and dysregulation. *Developmental Psychology, 35*(2), 335–346. https://doi.org/10.1037/0012-1649.35.2.335

Pope, A. W., Bierman, K. L., & Mumma, G. H. (1991). Aggression, hyperactivity, and inattention-immaturity: Behavior dimensions associated with peer rejection in elementary school boys. *Developmental Psychology, 27*(4), 663–671. https://doi.org/10.1037/0012-1649.27.4.663

Porges, S. W. (1995). Cardiac vagal tone: A physiological index of stress. *Neuroscience and Biobehavioral Reviews, 19*(2), 225–233. https://doi.org/10.1016/0149-7634(94)00066-A

Porges, S. W. (2007). The polyvagal perspective. *Biological Psychology, 74*(2), 116–143. https://doi.org/10.1016/j.biopsycho.2006.06.009

Posner, M. I., & Rothbart, M. K. (2000). Developing mechanisms of self-regulation. *Development and Psychopathology, 12*(3), 427–441. https://doi.org/10.1017/S0954579400003096

Posner, M. I., & Rothbart, M. K. (2007). *Educating the human brain*. Washington, DC: American Psychological Association. https://doi.org/10.1037/11519-000

Potegal, M., Kosorok, M. R., & Davidson, R. J. (1996). The time course of angry behavior in the temper tantrums of young children. In C. F. Ferris, T. Grisso, C. F. Ferris, & T. Grisso (Eds.), *Understanding aggressive behavior in children* (pp. 31–45). New York, NY: New York Academy of Sciences.

Prinstein, M. J., Choukas-Bradley, S. C., Helms, S. W., Brechwald, W. A., & Rancourt, D. (2011). High peer popularity longitudinally predicts adolescent health risk behavior, or does it? An examination of linear and quadratic associations. *Journal of Pediatric Psychology, 36*(9), 980–990. https://doi.org/10.1093/jpepsy/jsr053

Putnam, S. P., Gartstein, M. A., & Rothbart, M. K. (2006). Measurement of fine-grained aspects of toddler temperament: The early childhood behavior questionnaire. *Infant Behavior & Development, 29*(3), 386–401. https://doi.org/10.1016/j.infbeh.2006.01.004

Putnam, S. P., Sanson, A. V., & Rothbart, M. K. (2002). Child temperament and parenting. In M. H. Bornstein & M. H. Bornstein (Eds.), *Handbook of parenting: Children and parenting* (Vol. 1, 2nd ed., pp. 255–277). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Riley, W. T., Treiber, F. A., & Woods, M. G. (1989). Anger and hostility in depression. *Journal of Nervous and Mental Disease, 177*(11), 668–674. https://doi.org/10.1097/00005053-198911000-00002

Rose-Krasnor, L., & Denham, S. (2009). Social-emotional competence in early childhood. In K. H. Rubin, W. M. Bukowski, & B. Laursen (Eds.), *Handbook of peer interactions, relationships, and groups* (pp. 162–179). New York, NY: Guilford Press.

Rosen, P. J., Milich, R., & Harris, M. J. (2012). Dysregulated negative emotional reactivity as a predictor of chronic peer victimization in childhood. *Aggressive Behavior, 38*(5), 414–427. https://doi.org/10.1002/ab.21434

Rothbart, M., & Bates, J. (2006). Temperament. In N. Eisenberg, W. Damon, & L. M. Richard (Eds.), *Handbook of child psychology: Vol. 3, Social, emotional and personality development* (6th ed., pp. 99–166). Hoboken, NJ: Wiley.

Rothbart, M. K., Ahadi, S. A., & Hershey, K. L. (1994). Temperament and social behavior in childhood. *Merrill-Palmer Quarterly: Journal of Developmental Psychology, 40*(1), 21–39.

Rothbart, M. K., Ahadi, S. A., Hershey, K. L., & Fisher, P. (2001). Investigations of temperament at three to seven years: The children's behavior questionnaire. *Child Development, 72*(5), 1394–1408. https://doi.org/10.1111/1467-8624.00355

Rothbart, M. K., Derryberry, D., & Hershey, K. (2000). Stability of temperament in childhood: Laboratory infant assessment to parent report at seven years. In V. J. Molfese & D. L. Molfese (Eds.), *Temperament and personality development across the life span* (pp. 85–119). Hillsdale, NJ: Erlbaum.

Rozanski, A., Blumenthal, J. A., & Kaplan, J. (1999). Impact of psychological factors on the pathogenesis of cardiovascular disease and implications for therapy. *Circulation, 99*(16), 2192–2217. https://doi.org/10.1161/01.CIR.99.16.2192

Rubin, K. H., Bukowski, W. M., & Parker, J. G. (2006). Peer interactions, relationships, and groups. In N. Eisenberg, W. Damon, & R. M. Lerner (Eds.), *Handbook of child psychology: Vol. 3, Social, emotional, and personality development* (6th ed., pp. 571–645). Hoboken, NJ: Wiley.

Rubin, K. H., Burgess, K. B., Dwyer, K. M., & Hastings, P. D. (2003). Predicting preschoolers' externalizing behaviors from toddler temperament, conflict, and maternal negativity. *Developmental Psychology, 39*(1), 164–176. https://doi.org/10.1037/0012-1649.39.1.164

Rydell, A., Berlin, L., & Bohlin, G. (2003). Emotionality, emotion regulation, and adaptation among 5- to 8-year-old children. *Emotion, 3*(1), 30–47. https://doi.org/10.1037/1528-3542.3.1.30

Rydell, A., Thorell, L. B., & Bohlin, G. (2007). Emotion regulation in relation to social functioning: An investigation of child self-reports. *European Journal of Developmental Psychology, 4*(3), 293–313. https://doi.org/10.1080/17405620600783526

Saarni, C., Campos, J. J., Camras, L. A., & Witherington, D. (2006). Emotional development: Action, communication, and understanding. In N. Eisenberg, W. Damon, R. M. Lerner, N. Eisenberg, W. Damon, & R. M. Lerner (Eds.), *Handbook of child psychology: Social, emotional, and personality development* (Vol. 3, 6th ed., pp. 226–299). Hoboken, NJ: Wiley.

Saarni, C., Mumme, D. L., & Campos, J. J. (1998). Emotional development: Action, communication, and understanding. In W. Damon (Ed.), *Handbook of child psychology: Social, emotional, and personality development* (Vol. 3, 5th ed., pp. 237–309). New York, NY: Wiley.

Salmivalli, C., & Nieminen, E. (2002). Proactive and reactive aggression among school bullies, victims, and bully-victims. *Aggressive Behavior, 28*(1), 30–44. https://doi.org/10.1002/ab.90004

Saudino, K. J. (2005). Special article: Behavioral genetics and child temperament. *Journal of Developmental and Behavioral Pediatrics, 26*(3), 214–223. https://doi.org/10.1097/00004703-200506000-00010

Schneider, R. H., Egan, B. M., Johnson, E. H., Drobny, H., & Julius, S. (1986). Anger and anxiety in borderline hypertension. *Psychosomatic Medicine, 48*(3–4), 242–248. https://doi.org/10.1097/00006842-198603000-00009

Schwartz, D., Gorman, A., Nakamoto, J., & McKay, T. (2006). Popularity, social acceptance, and aggression in adolescent peer groups: Links with academic performance and school attendance. *Developmental Psychology, 42*(6), 1116–1127. https://doi.org/10.1037/0012-1649.42.6.1116

Shaw, D. S., Bell, R. Q., & Gilliom, M. (2000). A truly early starter model of antisocial behavior revisited. *Clinical Child and Family Psychology Review, 3*(3), 155–172. https://doi.org/10.1023/A:1009599208790

Shaw, D. S., Gilliom, M., Ingoldsby, E. M., & Nagin, D. S. (2003). Trajectories leading to school-age conduct problems. *Developmental Psychology, 39*(2), 189–200. https://doi.org/10.1037/0012-1649.39.2.189

Shaw, D. S., Keenan, K., & Vondra, J. I. (1994). Developmental precursors of externalizing behavior: Ages 1 to 3. *Developmental Psychology, 30*(3), 355–364. https://doi.org/10.1037/0012-1649.30.3.355

Shiner, R. L., Buss, K. A., McClowry, S. G., Putnam, S. P., Saudino, K. J., & Zentner, M. (2012). What is temperament now? Assessing progress in temperament research in the 25 years following Goldsmith et al. (1987). *Child Development Prospectives, 6*(4), 436–444. https://doi.org/10.1111/j.1750-8606.2012.00254.x

Shipman, K., Zeman, J., & Stegall, S. (2001). Regulating emotionally expressive behavior: Implications of goals and social partner from middle childhood to adolescence. *Child Study Journal, 31*(4), 249–268.

Shipman, K. L., Zeman, J., Nesin, A. E., & Fitzgerald, M. (2003). Children's strategies for displaying anger and sadness: What works with whom? *Merrill-Palmer Quarterly, 49*(1), 100–122. https://doi.org/10.1353/mpq.2003.0006

Smeekens, S., Riksen-Walraven, J. M., & van Bakel, H. A. (2007). Multiple determinants of externalizing behavior in 5-year-olds: A longitudinal model. *Journal of Abnormal Child Psychology, 35*(3), 347–361. https://doi.org/10.1007/s10802-006-9095-y

Smith, C. L., Calkins, S. D., & Keane, S. P. (2006). The relation of maternal behavior and socialization of emotion regulation: The moderating role of children's negative emotional attachment security to toddlers' emotions and emotion regulation. *Research in Human Development, 3*(1), 21–31. https://doi.org/10.1207/s15427617rhd0301_3

Snyder, J., Stoolmiller, M., Wilson, M., & Yamamoto, M. (2003). Child anger regulation, parental responses to children's anger displays, and early child antisocial behavior. *Social Development, 12*(3), 335–360. https://doi.org/10.1111/1467-9507.00237

Spence, S. H., De Young, A., Toon, C., & Bond, S. (2009). Longitudinal examination of the associations between emotional dysregulation, coping responses to peer provocation, and victimization in children. *Australian Journal of Psychology, 61*(3), 145–155. https://doi.org/10.1080/00049530802259076

Sroufe, L. A. (1996). *Emotional development: The organization of emotional life in the early years*. New York, NY: Cambridge University Press. https://doi.org/10.1017/CBO9780511527661

Steinberg, L. (2004). Risk taking in adolescence: What changes, and why? In R. E. Dahl & L. Spear (Eds.), *Adolescent brain development: Vulnerabilities and opportunities* (pp. 51–58). New York: NY: New York Academy.

Stifter, C. A., & Dollar, J. M. (2016). Temperament and developmental psychopathology. In D. Cicchetti (Ed.), *Developmental psychopathology* (Vol. 3, 3rd ed., pp. 546–607). New York, NY: Wiley.

Suarez, E. C., & Krishnan, K. R. (2006). The relation of free plasma tryptophan to anger, hostility, and aggression in a nonpatient sample of adult men and women. *Annals of Behavioral Medicine, 31*(3), 254–260. https://doi.org/10.1207/s15324796abm3103_7

Szewczyk-Sokolowski, M., Bost, K. K., & Wainwright, A. B. (2005). Attachment, temperament, and preschool children's peer acceptance. *Social Development, 14*(3), 379–397. https://doi.org/10.1111/j.1467-9507.2005.00307.x

Thomas, S. P., Groer, M., Davis, M., Droppleman, P., Mozingo, J., & Pierce, M. (2000). Anger and cancer: An analysis of the linkages. *Cancer Nursing, 23*(5), 344–349. Retrieved from: http://journals.lww.com/cancernursingonline/pages/articleviewer.aspx?year=2000&issue=10000&article=00003&type=abstract

Thompson, R. A. (1994). Emotion regulation: A theme in search of definition. *Monographs of the Society for Research in Child Development, 59*(2/3), 25–52, 250–283. https://doi.org/10.2307/1166137

Thompson, R. A., Lewis, M. D., & Calkins, S. D. (2008). Reassessing emotion regulation. *Child Development Perspectives, 2*(3), 124–131. https://doi.org/10.1111/j.1750-8606.2008.00054.x

Tremblay, R. E., Japel, C., Pérusse, D., McDuff, P., Boivin, M., Zoccolillo, M., & Montplaisir, J. (1999). The search for the age of 'onset' of physical aggression: Rousseau and Bandura revisited. *Criminal Behaviour and Mental Health, 9*(1), 8–23. https://doi.org/10.1002/cbm.288

Tremblay, R. E., Masse, L. C., Pagani-Kurtz, L., & Vitaro, F. (1996). From childhood physical aggression to adolescent maladjustment: The Montreal prevention experiment. In R. D. V. Peters & R. J. McMahon (Eds.), *Preventing childhood disorders, substance abuse, and delinquency* (pp. 268–298). Thousand Oaks, CA: Sage.

Trentacosta, C. J., & Shaw, D. S. (2009). Emotional self-regulation, peer rejection, and antisocial behavior: Developmental associations from early childhood to early adolescence. *Journal of Applied Developmental Psychology, 30*(3), 356–365. https://doi.org/10.1016/j.appdev.2008.12.016

Underwood, M. K. (1997). Top ten pressing questions about the development of emotion regulation. *Motivation and Emotion, 21*(1), 127–147. https://doi.org/10.1023/A:1024482516226

Valiente, C., Swanson, J., & Lemery-Chalfant, K. (2012). Kindergartners' temperament, classroom engagement, and student–teacher relationship: Moderation by effortful control. *Social Development, 21*(3), 558–576. https://doi.org/10.1111/j.1467-9507.2011.00640.x

Van Honk, J., Harmon-Jones, E., Morgan, B. E., & Schutter, D. G. (2010). Socially explosive minds: The triple imbalance hypothesis of reactive aggression. *Journal of Personality, 78*(1), 67–94. https://doi.org/10.1111/j.1467-6494.2009.00609.x

Virkkunen, M., & Linnoila, M. (1993). Brain serotonin, type II alcoholism and impulsive violence. *Journal of Studies on Alcohol, Supplement, 11*, 163–169. https://doi.org/10.15288/jsas.1993.s11.163

Vitaro, F., Brendgen, M., & Tremblay, R. E. (2002). Reactively and proactively aggressive children: Antecedent and subsequent characteristics. *Journal of Child Psychology and Psychiatry, 43*(4), 495–505. https://doi.org/10.1111/1469-7610.00040

Wang, F. L., Eisenberg, N., Valiente, C., & Spinrad, T. L. (2016). Role of temperament in early adolescent pure and co-occurring internalizing and externalizing problems using a bifactor model: Moderation by parenting and gender. *Development and Psychopathology, 28*(4, Part 2), 1487–1504. https://doi.org/10.1017/S0954579415001224

Wasserman, D., Geijer, T., Sokolowski, M., Rozanov, V., & Wasserman, J. (2007). Genetic variation in the hypothalamic-pituitary-adrenocortical axis regulatory factor, T-box 19, and the angry/hostility personality trait. *Genes, Brain & Behavior, 6*(4), 321–328. https://doi.org/10.1111/j.1601-183X.2006.00259.x

Williams, J. E. (2010). Anger/hostility and cardiovascular disease. In M. Potegal, G. Stemmler, C. Spielberger, M. Potegal, G. Stemmler, & C. Spielberger (Eds.), *International handbook of anger: Constituent and concomitant biological, psychological, and social processes* (pp. 435–447). New York, NY: Springer Science + Business Media.

Williams, J. E., Nieto, F. J., Sanford, C. P., & Tyroler, H. A. (2001). Effects of an angry temperament on coronary heart disease risk: The Atherosclerosis Risk in Communities (ARIC) Study. *American Journal of Epidemiology, 154*(3), 230–235. https://doi.org/10.1093/aje/154.3.230

Zahn-Waxler, C., Cole, P. M., Richardson, D. T., & Friedman, R. J. (1994). Social problem solving in

disruptive preschool children: Reactions to hypothetical situations of conflict and distress. *Merrill-Palmer Quarterly, 40*(1), 98–119. Retrieved from http://www.jstor.org/stable/23087910

Zhou, Q., Main, A., & Wang, Y. (2010). The relations of temperamental effortful control and anger/frustration to Chinese children's academic achievement and social adjustment: A longitudinal study. *Journal of Educational Psychology, 102*(1), 180–196. https://doi.org/10.1037/a0015908

Sadness in Youth: Socialization, Regulation, and Adjustment

Janice Zeman, Margaret Cameron, and Natalee Price

Even a happy life cannot be without a measure of darkness, and the word happy would lose its meaning if it were not balanced by sadness.

Carl Jung (McGuire & Hull, 1977, pp. 451–452)

Abstract

Sadness is considered to be one of the basic human emotions and is elicited in response to experiences of loss (Ekman, Psychol Rev 99(3):550–553, 1992). The action tendencies associated with sadness are to withdraw but also to signal to others that support is needed (Campos et al., Dev Psychol 25(3):394–402, 1989). The role of social and cultural contexts is key in shaping children's emerging sadness management skills. As such, parents are considered the earliest socializers of children's sadness regulation, and they influence the ways in which children learn how, where, and to whom they express their sadness (Saarni, The development of emotional competence. Guilford Press, New York, 1999). A growing body of research indicates that peers are also influential in imparting norms concerning sadness expression. One proposed mediator of the relation between sadness socialization and psychosocial adjustment is children's sadness regulation, as socialization processes facilitate or impede children's learning of effective emotion regulation strategies. Accordingly, this chapter reviews the extant research examining parent and peer socialization of sadness and its relations to social and psychological functioning, with attention also paid to the development of sadness regulation in children and adolescents. We conclude by offering suggestions for future research directions to address gaps in the literature.

Sadness is thought to be a universal emotional state common to all humans, irrespective of national origin (Ekman, 1992; Ekman & Friesen, 1986). As such, sadness is worthy of study for a variety of reasons. First, sadness is experienced from birth onward and is frequently elicited in response to a range of minor to significant loss experiences (e.g., loss of a mitten to the death of a family member; Ekman & Friesen, 1986). Second, children must learn how to manage sadness experience and expression in ways that are adaptive and acceptable within their cultural context (Friedlmeier, Corapci, & Cole, 2011; Karnaze & Levine, 2018). That is, learning cultural display rules for sadness has significant implications for negotiating relationships within a variety of social contexts because each context

J. Zeman (✉) · M. Cameron
College of William and Mary, Department of Psychological Sciences, Williamsburg, VA, USA
e-mail: jlzema@wm.edu; mecameron01@email.wm.edu

N. Price
Miami University of Ohio, Department of Psychology, Oxford, OH, USA
e-mail: pricenn2@miamioh.edu

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_10

may require different expression rules (Saarni, 1999). Third, the socialization and regulation of sadness expression are associated with psychological adaptation and maladaptation (e.g., Chaplin, Cole, & Zahn-Waxler, 2005; Zeman, Shipman, & Suveg, 2002) that extend beyond the intuitive relation between sadness dysregulation and depression (Lazarus, 1991; Sanders, Zeman, Poon, & Miller, 2015).

From a developmental psychopathology perspective, the dynamic interplay between normative and atypical emotional development permits a more in-depth and well-defined picture of basic emotional processes (Rutter & Sroufe, 2000; Sroufe, 1990). Along these lines, it is important to differentiate normative experiences of sadness from clinical depression or dysthymia. For example, although sadness can be an aspect of clinical depression along with other emotions such as anger, guilt, and anxiety (Lazarus, 1991), it is not necessarily synonymous with or even essential for this diagnosis (American Psychiatric Association, 2013). Moreover, irritability, not sadness, is often considered a hallmark or defining feature of depression for children and adolescents (Fava et al., 2010). Accordingly, it is critical to understand how normative sadness is experienced, socialized, and regulated in children to fully understand its influence in the development, maintenance, and exacerbation of psychosocial maladaptation at later points in development. This chapter focuses on reviewing the extant literature regarding the experience, socialization, and regulation of normative sadness from infancy through adolescence and their relations to psychological and social adjustment.

We frame the review from within the functionalist theory of emotion (Barrett & Campos, 1987) in which emotions are conceptualized as primarily relational in nature (i.e., interpersonal focus), although the intrapersonal elements of emotions are also acknowledged. Further, under this framework, each emotion is posited to serve a unique function and has its own set of action tendencies. Concerning the specific function of sadness, Campos, Campos, and Barrett (1989) postulate that sadness occurs when one's goals are perceived as unattainable, and it is through expressions of sadness that interpersonal support and instrumental assistance are solicited from others. Further, experiences of sadness can prompt cognitive change that can help to reframe beliefs and goals related to the sadness-evoking situation (Karnaze & Levine, 2018). In the present literature review, we focus on contextual and relational aspects of sadness development. The first section focuses on the socialization of sadness by parents and peers. Within this section, we present the literature on parental sadness expressivity, followed by parental discussion of and responses to sadness that are initially discussed under the broad categories of supportive and unsupportive socialization practices. Then, the influences of child-level (i.e., age, gender, temperament, emotional competencies) and parent-level (i.e., gender, emotional competencies) variables on parent and peer sadness socialization are considered. The second section focuses on the development of sadness regulation from infancy through adolescence. We then review research that examines the outcomes of sadness socialization practices and sadness regulation as they relate to youth's psychological and social adjustment. We conclude by reflecting on the gaps in the literature and suggest possibilities for future research efforts.

Parental Sadness Socialization

Emotion socialization broadly refers to the ways in which socialization agents (e.g., parents) impart their values, beliefs, and practices associated with emotional expressivity to others (e.g., children; Eisenberg, Cumberland, & Spinrad, 1998; Zeman, Cassano, & Adrian, 2013). Parents socialize children's sadness in a multitude of ways that have been categorized as either direct or indirect (Bariola, Gullone, & Hughes, 2011; Cassano, Perry-Parrish, & Zeman, 2007; Gottman, Katz, & Hooven, 1997). However, the distinctions between these categories often become blurred as the methods used to assess them have elements of both direct and indirect communication about emotions. Parents may impart their beliefs about sadness to their children through their (a) own

sadness expressivity, (b) discussions of sadness, and (c) responses to their children's and others' sadness (Bariola et al., 2011; Cassano et al., 2007; Gottman et al., 1997; Miller-Slough & Dunsmore, 2016; Zeman, Cassano, Perry-Parrish, & Stegall, 2006). Individual differences in child-level factors (e.g., age, gender, temperament), parent-level factors (e.g., gender), and the nature of the parent-child relationship influence these emotion socialization practices (Eisenberg et al., 1998; Morris, Silk, Steinberg, Myers, & Robinson, 2007; Zeman et al., 2006).

Parental Sadness Expressivity

Patterns of verbal and nonverbal sadness-related expressions are one way that parents indirectly impart their beliefs about the acceptability of sadness to their children (Bariola et al., 2011; Halberstadt, Cassidy, Stifter, Parke, & Fox, 1995; Halberstadt & Eaton, 2002; Valiente & Eisenberg, 2006). This type of sadness socialization is exhibited through parents' expressions of sadness toward individual family members (e.g., modeling; Bariola et al., 2011) and their general style of sadness expressions within the broader family context (e.g., family emotional climate; Halberstadt, Crisp, & Eaton, 1999; Morris et al., 2007). Parental sadness expressivity may include parents' behaviors such as crying, sulking, and showing facial expressions of sorrow (Valiente, Fabes, Eisenberg, & Spinrad, 2004). Through these behaviors, parents communicate common behavioral tendencies associated with sadness, as well as the personal significance of sadness-eliciting events (Denham & Kochanoff, 2002; Denham, Mitchell-Copeland, Strandberg, Auerbach, & Blair, 1997; Halberstadt & Eaton, 2002). Heightened parental sadness expressivity may be indicative of parents' maladaptive ways of managing emotions (e.g., exaggerated emotional displays) or their unsupportive emotion socialization patterns (e.g., inattentive or punitive practices; Eisenberg et al., 2001; Garner, 1995). Whether they are observing beneficial or deleterious patterns, children frequently imitate their parents' sadness expressivity through modeling and social referencing (Brand & Klimes-Dougan, 2010; Casey & Fuller, 1994; Garside, 2004).

Parental Sadness Discussions and Responses

Parents also socialize their youths' sadness through their verbal and nonverbal responses to their children's sadness in day-to-day activities, as well as through their discussions of past and current emotional events (Eisenberg et al., 1998; Gottman et al., 1997; Miller-Slough & Dunsmore, 2016). These reactions and conversations provide a venue through which parents can help their children label and understand their sad feelings, process contextual factors preceding and following emotion-laden events, and learn about the situational appropriateness of sadness displays (Denham et al., 1997; Denham & Kochanoff, 2002; Morris et al., 2007). It is important to note that supportive and unsupportive sadness socialization responses are not simply flip sides of the same coin; parents may respond in both ways to their child, even within the same setting and discussion (Lunkenheimer, Shields, & Cortina, 2007).

Supportive Discussion Styles and Responses

Gottman et al.'s (1997) *meta-emotion* philosophy posits that parents' own awareness, beliefs, and feelings about the expression of sadness likely influence how they subsequently react to and discuss their children's emotional behaviors (Cassano et al., 2007; Katz, Maliken, & Stettler, 2012). *Emotion-coaching* parents tend to exhibit awareness and acceptance of their own and others' emotions and may aid their children's attempts to adaptively regulate and discuss their sadness (Denham et al., 1997; Gottman et al., 1997). By validating and labeling their children's sadness and discussing strategies for managing sadness-provoking situations, parents provide the message, directly and indirectly, that sadness is an acceptable emotion to experience and express (Buckholdt, Kitzmann, & Cohen, 2016; Poon, Zeman, Miller-Slough,

Sanders, & Crespo, 2017). Parents engaging in this style help their children distinguish between feelings of sadness and other emotions (Denham & Kochanoff, 2002). However, if the communication primarily concerns only certain emotions (e.g., sadness) to the exclusion of others, parents implicitly and perhaps unintentionally teach their children that sadness is more significant than other emotions (Fivush, Brotman, Buckner, & Goodman, 2000).

With respect to *supportive responses*, O'Neal and Magai (2005) have categorized parents' supportive sadness socialization behaviors as reflecting *rewarding*, *overriding*, and *magnifying* responses to youths' sadness displays. Additionally, Fabes, Poulin, Eisenberg, and Madden-Derdich (2002) have identified *problem-focused* and *emotion-focused* responses as indicating supportive parental reactions. Problem-focused responses occur when parents attempt to help solve the problem that caused their child's distress, whereas emotion-focused responses involve parents working to alleviate their child's distress through comforting behaviors. Within O'Neal and Magai's (2005) framework, the reward category denotes parents comforting their child and exhibiting their willingness to discuss and facilitate problem-solving strategies for sadness-evoking situations (Klimes-Dougan et al., 2007; O'Neal & Magai, 2005). This reward response is similar to Fabes et al.'s (2002) conceptualizations of *expressive encouragement* as reflecting parents' attempts to encourage and validate their children's sadness expressions. Through *overriding* behaviors, parents attempt to alleviate their child's distress by distracting them from their sadness or downplaying the seriousness of their sadness experience (e.g., telling the child to cheer up, buying the child a gift; Miller-Slough & Dunsmore, 2016; O'Neal & Magai, 2005). Finally, *magnification* (alternatively known as a *distress* reaction) may occur when parents respond to their children's sadness displays by matching such expressions (e.g., a parent becomes sad at their child's sadness; Fabes et al., 2002; Klimes-Dougan et al., 2007).

From Gottman et al.'s (1997) meta-emotion theory, override and magnification responses would not be considered truly supportive or emotion-coaching responses, even if well intended, as they do not validate the child's sadness experience. In fact, research finds that, in some contexts, children may perceive override and magnify responses as unsupportive (Buckholdt, Parra, & Jobe-Shields, 2009; Garside, 2004) and that magnifying reactions to sadness sometimes relate to maladaptive outcomes for children (Buckholdt et al., 2009; Garside & Klimes-Dougan, 2002). More generally, parental and peer supportive responses to youth's sadness are more common than unsupportive responses (Jobe-Shields, Parra, Buckholdt, & Tillery, 2014; Klimes-Dougan et al., 2014; Miller-Slough & Dunsmore, 2016) and may facilitate youth's socioemotional competence (McElwain, Halberstadt, & Volling, 2007; Spinrad, Stifter, Donelan-McCall, & Turner, 2004).

Unsupportive Discussion Styles and Responses

Gottman et al. (1997) characterize parents who are uncomfortable with their children's expression of emotions as primarily relying on *emotion-dismissing* strategies. They may invalidate or minimize the importance of their children's sadness in their parent-child emotion discussions or attempt to alter the emotional experience themselves, rather than viewing sadness expression as natural and an opportunity for teaching coping strategies (Gottman et al., 1997; Poon et al., 2017). Consequently, these parents may have fewer emotion-oriented discussions with their children (Klimes-Dougan et al., 2007), communicating the message that emotions are fundamentally deleterious, dangerous, and should not be expressed (Cassano et al., 2007). Although some parents may be generally supportive of their children, they may have difficulty coping with their children's sadness displays or may believe that avoidance of emotion is most beneficial for their children, thereby possibly inadvertently engaging in emotion-dismissing practices (Buckholdt et al., 2016;

Denham & Kochanoff, 2002; Hooven, Gottman, & Katz, 1995).

Specific unsupportive emotional responses may involve *punishing* and *neglecting* youths' sadness displays (O'Neal & Magai, 2005), which are similar to other researchers' identification of *punitive* (Fabes et al., 2002) and *ignoring* (Mirabile, 2015) responses, respectively. Parents may *punish* their children's expressions of sadness by expressing disapproval toward or mocking/teasing their sadness displays (Klimes-Dougan et al., 2007). Additionally, parents may *neglect* their youths' sadness by ignoring, not noticing, or not being available to respond to their sadness expressions (Klimes-Dougan et al., 2007; O'Neal & Magai, 2005). Fabes et al. (2002) include parents' *minimization* reactions in their unsupportive socialization responses, which are responses that devalue children's sadness displays.

Child-Level Factors

Age

Infants and toddlers express their sad feelings at a greater frequency and intensity than their anger expressions (Buss & Kiel, 2004), and their sadness displays are commonly imitated, or magnified, by parents (Malatesta, Grigoryev, Lamb, Albin, & Culver, 1986). Toddlers are also frequently presented with novel, and sometimes stressful, situations that may trigger distress and sadness. In comparison to other emotions, sadness expression elicits different, more helpful responses from mothers (Hutt, Buss, & Kiel, 2013). Toddlers who exhibit greater sadness tend to bring about more protective responses from caregivers, which, in turn, contribute to toddlers' increased cortisol levels (Hutt et al., 2013). Overall, it appears to be functional for infants and toddlers to display their sadness, at least to the extent that other negative emotions (e.g., anger) may alternatively provoke punitive reactions or neglect (Buss & Kiel, 2004). With repeated experiences over time, infants and toddlers may learn to associate their sadness displays with positive maternal responses (Buss & Kiel, 2004; Luebbe, Kiel, & Buss, 2011).

Elementary-school-age children commonly report anticipating and receiving supportive parental reactions (e.g., problem-solving, rewarding, overriding responses) following expressions of sadness (Buckholdt et al., 2009; Ersay, 2014; Raver & Spagnola, 2002), especially when compared to parents' more unsupportive responses to anger displays (Edwards, Shipman, & Brown, 2005; Fuchs & Thelen, 1988; Zeman, Dallaire, & Borowski, 2016; Zeman & Shipman, 1996). Parents are generally unlikely to respond with neglecting emotional responses (Buckholdt et al., 2009), and across parent and peer audiences, children expect to receive more support following their crying and sad facial expressions than when sulking or aggressively acting out (Shipman, Zeman, Nesin, & Fitzgerald, 2003). In contrast, children anticipate the most parent or peer conflict in response to these latter dysregulated sadness expressivity behaviors (Shipman et al., 2003). As such, children begin to differentiate between acceptable and unacceptable sadness displays and are more likely to express their sadness when there are expectations of receiving comforting and supportive responses from parents or peers (Underwood, Coie, & Herbsman, 1992; Zeman & Garber, 1996; Zeman & Shipman, 1996).

As children enter adolescence, some research suggests that parents remain generally attentive to youths' sadness displays, with supportive responses being more commonplace, particularly in comparison to other emotions (O'Neal & Magai, 2005). In some research, however, adolescents report anticipating more understanding responses to their anger than sadness and are more likely to inhibit their sadness in the presence of parents, suggesting that they have received negative socialization messages about expressing vulnerable emotions (i.e., sadness; Sorber, 2001; Zeman & Shipman, 1997). Along these lines, Klimes-Dougan et al. (2007) found that child age, but not child gender, appears to be a salient factor that contributes to parents' sadness socialization practices. Specifically, older adolescents report receiving fewer rewarding

and more neglecting responses to sadness from parents than younger youth (Klimes-Dougan et al., 2007).

Given the bidirectional nature of socialization processes, adolescents' own reactions to their parents' supportive socialization efforts may also influence how parents socialize their youths' sadness (Parra, Olsen, Buckholdt, Jobe-Shields, & Davis, 2010). Specifically, researchers have conceptualized adolescents as responding to parents with *accepting*, *avoidant*, or *attacking* reactions (Jobe-Shields et al., 2014; Parra et al., 2010). Youths' appreciative or *accepting* responses may reinforce supportive parental behaviors, resulting in greater rewarding and fewer punishing or neglecting parent responses to sadness displays (Parra et al., 2010). *Avoidant* or withdrawal-based responses may stem from adolescents' protective goals to avoid worrying a parent or be due to low expectations of parental emotion regulation abilities. *Attacking* responses involve critical, sarcastic, and incriminating reactions that may be particularly salient to youth who are uncomfortable with their sad feelings. Such hostile reactions likely promote a discontinuation of parents' comforting efforts and reduce adolescents' opportunities to learn adaptive sadness regulation skills. Of note, Parra et al. (2010) also find that very few youth (3–14%) displayed one primary reaction type. Thus, adolescents may employ a variety of approaches to their parents' efforts to respond to their sadness.

Gender

Parental engagement in sadness discussions and responses to child's sadness differ by child gender. Starting in infancy, parents tend to provide more attentive reactions to the cries of infant sons than daughters (Block, 1983). Additional findings indicate that mothers may be equally or less likely to respond to infant daughters' than sons' displays of sadness (Malatesta et al., 1986). For children as young as 3 years of age, parents seem to encourage girls' but discourage boys' expressions of sadness (e.g., Adams, Kuebli, Boyle, & Fivush, 1995; Fivush et al., 2000; Kuebli & Fivush, 1992). Specifically, parents use more sadness terms (e.g., "sad," "cried"), explore more emotional aspects of sad events, and provide greater comfort to their daughters' than their sons' sadness displays (Adams et al., 1995; Fivush, 1989, 1991). Conversely, parents tend to encourage greater sadness inhibition in sons than in daughters (Block, 1983; Chaplin et al., 2005; Fivush, 1991; Fivush et al., 2000).

In school-age children, there is evidence for the continuation of gendered patterns of parental sadness socialization. Some research suggests that parents more frequently mention sadness before the child does in emotion discussions with daughters than with sons (Aldrich & Tenenbaum, 2006). Further, in comparison to daughters, sons receive more emotion-dismissing responses in sadness discussions (Poon et al., 2017). Parents also expect less sadness inhibition but greater ability to manage sadness effectively from their daughters than from their sons (Cassano et al., 2007). Further, Cassano and Zeman (2010) found that parents socialize sadness in gendered patterns depending on their perceptions of their child's sadness regulation abilities. Specifically, when parents perceive their children, especially sons, as exhibiting poorer sadness regulation, they tailor their responses to offer greater focus on the causes or reasons for sadness, but do not use emotion-coaching strategies. Interestingly, fathers cite mothers as responding *more* supportively to sons' than daughters' sadness displays, and mothers believe fathers to be more supportive of girls' than boys' sadness expressions (Cassano, Zeman, & Sanders, 2014).

With respect to responses to children's sadness displays, parents are more attentive to and offer greater encouragement of sadness expression in their daughters than in their sons (Chaplin et al., 2005; Fabes & Martin, 1991; Garside, 2004; Tillery, Cohen, Parra, Kitzmann, & Howard Sharp, 2015). Similarly, boys report expecting and receiving less favorable parental reactions to sadness displays than girls (Ersay, 2014; Fuchs & Thelen, 1988; Garside & Klimes-Dougan, 2002; Zeman & Garber, 1996). These findings may help explain why young girls report feeling better than boys after displaying sadness (Zeman & Shipman, 1996).

It is important to note that other studies have found few or no child gender differences in parents' sadness socialization responses in this age group (Aldrich & Tenenbaum, 2006; Cassano et al., 2014; Ersay, 2014; Tillery et al., 2015). Taken together, the literature on child gender differences in sadness socialization provides insight into the complexity of understanding how sadness in boys and girls is socialized within families and suggests that there may be other moderating or mediating factors playing a role in these practices.

Temperament

Child disposition is an additional proposed influence on parental sadness socialization practices (Garner, 1995; Garside, 2004; Root & Rasmussen, 2017). For instance, parents may react to toddlers' sadness displays by using more guiding and socializing language particularly for those children who often display heightened sadness expressivity and/or have greater difficulty in social situations (Denham et al., 1997). In contrast, other research found no direct nor indirect relation between toddlers' negative affect and mothers' responses to sadness and fear displays (Luebbe et al., 2011). Perhaps parents' perceptions of high levels of distress in their toddler may prompt parents to provide inconsistent supportive responses to such displays, thereby obscuring any potential association between toddler affect and maternal emotional responses (Luebbe et al., 2011).

Emotional Competencies

Another child-level variable that affects parental responses is children's emotional competencies. For example, children with strong emotion management skills may be less sensitive to unsupportive parental reactions and thus buffered against prospective depressive symptomatology (Sanders et al., 2015). Parents' expectations of their children's sadness management skills impact their socialization responses. Specifically, children who exhibit heightened sadness expressivity tended to receive more minimizing and fewer emotion-coaching responses from their parents (Cassano et al., 2007).

Atypical Environments

Another factor to consider is a child's unique environmental context, which includes their psychological adjustment as well as their home-rearing environment. For example, adolescents with psychological problems are more likely to report receiving more neglecting, fewer rewarding, and fewer overriding responses to their sadness displays than well-adjusted youth (Klimes-Dougan et al., 2007). In contrast, other research suggests that parents of depressed adolescents may be more likely to provide rewarding responses than parents of typically developing adolescents, though such responses may inadvertently reinforce dysregulated sadness displays (Schwartz, Sheeber, Dudgeon, & Allen, 2012). Regarding emotion socialization responses within an atypical home environment, when compared to non-maltreated youth, children who have been sexually maltreated anticipate receiving fewer supportive responses and more conflict when expressing sadness to their parents (Shipman, Zeman, Penza, & Champion, 2000). In sum, social context is a key factor to consider when studying emotion socialization processes.

Parent-Level Factors

Gender

Parent gender is an important factor in parental sadness socialization practices. From toddlerhood through adolescence, children and their mothers report that mothers are more comfortable with and accepting of children's sadness than fathers (Hooven et al., 1995; Klimes-Dougan et al., 2007; Sanders et al., 2015). Specifically, mothers report using supportive, emotion-coaching strategies (i.e., reward, override, magnify, problem-focused) more frequently than fathers (Garside, 2004; Garside & Klimes-Dougan, 2002; Klimes-Dougan et al., 2007), whereas fathers more routinely respond to their children's sadness with minimization, neglect, and punishment (Fuchs & Thelen, 1988; Garside, 2004; Garside & Klimes-Dougan, 2002). Interestingly, during discussions of sadness with their child, fathers spend more time discussing emotional states (i.e., how one

feels), whereas mothers more often discuss the causes of sadness (Cassano & Zeman, 2010). However, mothers may also be more likely than fathers to be unsatisfied with their children's sadness regulation skills (Cassano et al., 2007) and may explicitly convey their expectations of appropriate sadness expression to younger children (Zeman, Penza, Shipman, & Young, 1997).

Emotional Competencies

Parents' own emotional competencies are emerging as a factor in sadness socialization processes. Both Eisenberg et al. (1998) and Morris et al. (2007) posit that parents' emotion-related characteristics (e.g., how they regulate emotions) may impact how they socialize their children's emotions. There has been some empirical support for these models. Insofar as parents are aware of their own sad feelings, they engage in more emotion-coaching (i.e., affectionate responses) and fewer emotion-dismissing behaviors (i.e., ridiculing humor) in sadness discussions with their children (Gottman et al., 1997; Hooven et al., 1995). Some researchers also propose that sadness socialization via emotion discussions may be situation specific (Adams et al., 1995). For instance, the conversational topic may exert influence over these practices, such that fathers may be more apt to coach, discuss, and express sadness when they are attributing such feelings to story protagonists, rather than to themselves or their children (Aldrich & Tenenbaum, 2006).

Peer Sadness Socialization

Researchers have only recently begun to examine the role of peers as emotion socializers (for a review, see Miller-Slough & Dunsmore, 2016), and therefore, there has been little focus on investigating individual emotions such as sadness. However, research does indicate that children in first grade are aware of how their sadness expressions elicit different responses by friends than parents and that this awareness subsequently influences their decisions to express or dissemble sadness (e.g., Zeman et al., 1997; Zeman & Garber, 1996; Zeman & Shipman, 1997). In fact, as children enter adolescence, peers appear to become preferred recipients of sadness disclosures, over and above parents (Saarni, 1988; Underwood, 1997). Thus, it appears that peer sadness socialization influences are operating, but there is little documentation of these processes to date (Parke et al., 2002; Strayer & Roberts, 2004).

Peer sadness socialization processes are thought to be similar to parental sadness socialization practices (Legerski, Biggs, Greenhoot, & Sampilo, 2015; Miller-Slough & Dunsmore, 2016). Children learn sadness expressivity norms for friendships and peer groups by navigating sadness displays as well as by modeling and discussing this emotion (Legerski et al., 2015; Morris et al., 2007). Further, the same supportive and unsupportive responses to sadness expressivity documented in the parental sadness socialization literature also emerge as relevant categories for peer socialization of sadness (e.g., Brand & Klimes-Dougan, 2010; Klimes-Dougan et al., 2014; Parr, Zeman, Braunstein, & Price, 2016).

Regarding modeling, researchers propose that children watch their friend's emotional expressions to learn the expressivity norms in the peer group (Denham, 2007). For example, girls who report greater sadness intensity during a conflict with their friend have friendlier conflict-resolving goals, and boys who endorse less intense sadness have more positive and friend-oriented goals during a conflict (Murphy & Eisenberg, 2002). Another body of related research has examined how youth's depressive symptomatology may contribute to their friends' greater sad affect (e.g., Conway, Rancourt, Adelman, Burk, & Prinstein, 2011; Deater-Deckard, 2001).

Some studies have assessed the patterns associated with peers' responses to the sadness displays of their friends. Although supportive responses to sadness may be customary for children in friendships, particularly in contrast to other emotions (Denham, 2007; Underwood, 1997), children still report receiving more supportive responses from their mothers than their peers (Zeman & Garber, 1996). Children

cite expecting more teasing and/or negative interpersonal consequences from friends than parents for sadness disclosures (Saarni, 1988; Underwood, 1997; Zeman & Garber, 1996). It may be that children learn to adopt a stoic "front" that allows them to feel sad while still publicly remaining unperturbed (Denham, 2007; Saarni, 1988). Interestingly, children indicate a preference for sad playmates over angry ones, possibly because sadness indicates less of an overt threat than anger (Sorber, 2001; Sorber & Cunningham, 1999). Additionally, in simulations of emotion-displaying characters, youth anticipate sad children receiving less teasing from their peers than fearful characters (Sorber, 2001). Finally, Denham (2007) posits that children may participate in negative gossip to strengthen peer group identities or share support, sympathy, and affection with one another. Thus, considerable research is needed to better understand the processes that underlie peer socialization of sadness.

Child-Level Factors

Age and Gender

Concerning age, younger (i.e., kindergarten age) children expect sad characters to be better liked and receive more social invitations and help from their peers than do older (i.e., third grade) children (Sorber, 2001). Further, first-grade children are also more likely than fifth-grade children to report favorable peer responses to sadness (Zeman & Garber, 1996). In addition, middle-school-age boys who display their sadness to other boys are liked less than boys who do not express their sadness, whereas there is no significant relation between sadness expression and peer acceptance for girls (Perry-Parrish & Zeman, 2011). Taken together, these findings suggest that although sadness expressions may be acceptable in early childhood, with increasing age, children, especially boys, may dampen their sadness expressions around their peers (Sorber, 2001; Zeman & Garber, 1996; Zeman & Shipman, 1997).

Regarding the role of child gender and age in these processes, there is some evidence to suggest that girls and younger children anticipate more supportive responses from their friends than boys and older children. Girls are more likely to report receiving rewarding responses to their sadness than boys (Tillery et al., 2015). Sorber (2001) hypothesizes that because sadness displays may convey vulnerability, they may seem counterintuitive to boys' dominance- and competition-oriented goals within the peer group. Thus, it is not surprising that boys expect animated characters displaying sadness to receive more teasing responses from their peers than do girls (Sorber, 2001). Moreover, children seem to prefer sad girls as playmates compared to sad boys (Sorber & Cunningham, 1999).

In sum, a growing body of research recognizes parents as important sadness socialization agents via their sadness expressivity patterns, their discussions of sadness with their children, and their responses to their children's sadness displays. Notably, parents' responses to their children's sadness are influenced by a variety of child-level (i.e., age, gender, temperament) and parent-level (i.e., gender, emotional competencies) factors. The field of peer sadness socialization research is just beginning to emerge. This research offers considerable promise for meaningful contributions to our understanding of how sadness processes in children and adolescents may differ in response to the unique social demands present in friendships and the peer context. One aspect of emotional competence that is affected by parent and peer socialization is the development of children's sadness regulation skills, the focus of the next section.

Sadness Regulation

Sadness regulation refers to the ways in which individuals (e.g., children) monitor, evaluate, and alter their sadness expressions and experiences (Thompson, 1994). Children begin regulating their sadness in infancy, and their methods derive from both *extrinsic* (e.g., caregiver interactions)

and *intrinsic* (e.g., child temperament) sources of influence (Calkins & Hill, 2007; Gross, Sheppes, & Urry, 2011). Children's emotion regulation abilities and employed strategies vary throughout developmental periods and are influenced by a variety of child-level factors (i.e., age, gender) and their social environment. The next section of the review explores the literature examining these factors in relation to sadness regulation.

Child-Level Factors

Child Age

Infancy Research indicates that young infants' sadness expressions are not frequently seen in isolation but instead tend to overlap with anger or distress/pain expressions (Camras, 1982; Camras, Malatesta, & Izard, 1991; Gartstein & Rothbart, 2003; Hyson & Izard, 1985). Researchers postulate that in young infants, anger and sadness may differ from each other, in that anger is an approach-oriented emotion, whereas sadness is a withdrawal-oriented emotion (e.g., Camras et al., 1991). With development, the complexity of emotional responses tends to increase with early and persistent individual differences (Hyson & Izard, 1985).

Self-soothing in response to one's own sadness is a form of sadness regulation that emerges in infants as young as 10 weeks old (Haviland & Lelwica, 1987). For instance, after watching their mothers' sad facial expressions, babies demonstrate more "mouthing" behaviors (i.e., "lip and tongue sucking and pushing the lips in and out") than when the infants see their mothers' happy or angry emotions (Haviland & Lelwica, 1987, p. 103). Since infants do not appear to mimic their mothers' expressions, some researchers propose that this mouthing response is a form of self-soothing (Crockenberg & Leerkes, 2004; Haviland & Lelwica, 1987). Infants also demonstrate the tendency to gaze down when they see a sad stimulus compared to gazing forward (i.e., joy stimuli) or to the side (i.e., anger stimuli; Haviland & Lelwica, 1987). Similarly, research examining 4-month-old infants' responsiveness to various facial expressions (i.e., anger, fear, sadness) in a game of peekaboo shows that infants look at adults' sadness expressions for less time than anger or fear expressions (Montague & Walker-Andrews, 2001). Infants' downward gaze and tendency to look away from sadness expressions appear to reflect early indicators of sadness regulation (Haviland & Lelwica, 1987).

Infants rely on familiar individuals' emotional expressions to interpret new situations and feelings in a process known as social referencing (Campos, 1982). Infants as young as 3.5 months old can discriminate between different emotional expressions of a parent, but not those of an unfamiliar adult (Walker-Andrews, Krogh-Jespersen, Mayhew, & Coffield, 2011). There appear to be developmental differences regarding infants' ability to discriminate between sadness expressions and happy expressions as well as their ability to generalize sadness expressions to people other than their parents. For example, researchers found that 10-month-old infants look at the mouth and eye regions for happy and sad faces in similar ways, but differ in their scans of fearful faces, demonstrating that the ability to interpret others' sadness may not be typical for infants of this age (Heck, Panneton, & Mills-Smith, 2016). With increasing age, infants experience gains in their ability to recognize sadness and display a variety of responses to others' sadness (Chiarella & Poulin-Dubois, 2015; Martin, Witherington, & Edwards, 2008). Older infants (16–18 months) compared to younger infants (12–13 months) show referential (i.e., the ability to connect others' emotion expressions to specific events) and affect (i.e., the likeliness to touch or comfort targets demonstrating specific emotion expressions) specificity for sadness and are thus able to relate sadness expressions to specific objects (Martin et al., 2008). Older infants (18 months) compared to younger infants (12–14 months) also demonstrate greater concern for sad people and exhibit more negative facial

expressions when looking at them (Chiarella & Poulin-Dubois, 2015; Martin et al., 2008). This response to others' sadness expressions is thought to reflect an increasing awareness of sadness (Martin et al., 2008).

Toddlerhood and Preschool Between 24 and 36 months of age, toddlers begin using words like "sad," "fear," and "anger" to describe their negative emotions, although the emotion labels may not always carry the same meanings as attributed by adults (Widen & Russell, 2008). Interestingly, research has found links between 18-month-old toddlers' ability to accurately label specific facial expressions, including sadness expressions, and parents' report of increases in toddlers' internalizing behaviors concurrently and at 36 months of age (Székely et al., 2014).

The ability to regulate sadness through self-soothing behaviors continues to develop into toddlerhood and preschool, enabling children to manage their emotions adaptively when experiencing new situations (Calkins & Hill, 2007; Garner, 1995; Stifter & Braungart, 1995). Such behaviors do appear to be efficacious in reducing children's distress and may even be a preferred regulatory strategy by young children (Calkins & Hill, 2007; Crockenberg & Leerkes, 2004; Stifter & Braungart, 1995). Toddlers also display greater sadness expression when they are with their mother, but tend to regulate their sadness (i.e., longer latency to distress times, less emotional lability, and more self-soothing behaviors) more with a stranger. Further, toddlers whose mothers report positive emotional expressiveness within the family demonstrate more self-soothing behavior, whereas toddlers of families with higher levels of mother-reported sadness expressivity are less likely to self-soothe (Garner, 1995).

In early childhood, facial expressions and behavioral responses that most notably signify sadness include "crying, [the] inner corners of [the] eyebrows lifted, [the] corners of lips down, and slow [and] steady-pitched speech" (Denham, 1998, p. 24). In addition, distinct vocal sounds have been attributed to preschoolers' sadness expression, such as fussing, whining, and crying rather than other vocal expressions like screaming and yelling (Green, Whitney, & Potegal, 2011).

Middle Childhood During middle childhood, children develop a deeper understanding of and an improvement in their use of cultural display rules (Saarni, 1999; Zeman et al., 2006). Display rules refer to norms that are defined by a culture and influence how individuals respond to and alter their emotional behavior based on the demands of specific social contexts (e.g., smiling when you receive a disappointing present, Saarni, 1984). As such, children learn from their culture, family, and peers when, where, and how to display their emotions to others.

Methods of Sadness Regulation To regulate their sadness, children report using strategies including, but not limited to distraction, social interaction (i.e., eliciting support from people), and withdrawal (e.g., Davis, Quiñones-Camacho, & Buss, 2016; Feng et al., 2009; Waters & Thompson, 2014). Affective responses like crying may be used less frequently for sadness than pain, but more frequently than for anger (Zeman & Garber, 1996). At around 5 years of age, children begin distracting themselves from their sadness by engaging in or thinking about enjoyable activities (Davis et al., 2016; Franko, Powers, Zuroff, & Moskowitz, 1985). Davis (2016) found that children's strategies such as cognitive reframing, mental distancing (i.e., thinking about how a sad event is not relevant), and positive reappraisal (i.e., thinking about how a sad event could turn out positively) are each linked to lower levels of sadness. However, rumination (i.e., thinking repetitively about one's feelings and the causes/effects of the sad event) is not associated with a substantial reduction in sadness (Davis, 2016).

In order to alleviate their sadness, children as young as 5 years old begin to seek social support from others (Skogstrøm Endrerud & Vikan, 2007; Waters & Thompson, 2014). Skogstrøm Endrerud

and Vikan (2007) note that regardless of age (i.e., 5 or 7 years old), children prefer to be with someone who will help them cope with their emotions when they are feeling sad. Further, for both 6- and 9-year-old children, emotion-focused strategies (i.e., seeking out adult support, "venting" about sad emotions) may be the most useful and effective ways for children to regulate their sadness (Waters & Thompson, 2014). Children also report that it is easier to manage sadness than anger, possibly due to the accessibility and acceptability of sadness regulation strategies, which tend to focus on the experience of sadness, compared to methods of anger regulation that predominately emphasize problem-solving approaches (Waters & Thompson, 2014). Further, children more easily identify sadness than anger regulation strategies (Cole, Dennis, Smith-Simon, & Cohen, 2009; Waters & Thompson, 2014). A third approach when regulating sadness is to withdraw from the situation (Zeman & Garber, 1996). Two types of withdrawal have been documented, including *passive* withdrawal, in which children do not directly express their sadness (e.g., moping around) and *active* withdrawal, in which children actively remove themselves from the situation (e.g., walking away). Both forms of withdrawal are thought to provide children with time and "space" to regulate their sadness. However, Leaberry, Rosen, Slaughter, and Fogleman (2018) found that withdrawing from a situation as a way to regulate sadness may be associated with negative outcomes, particularly for children with certain forms of psychopathology. Specifically, the researchers note that children with attention-deficit hyperactivity disorder and comorbid internalizing disorders are at increased risk for poor sadness regulation if they have increased negative affect *and* avoid/withdraw from situations.

Reasons Children Express or Inhibit Sadness Children most commonly report expressing their sadness to elicit supportive responses from others (Jenkins & Ball, 2000; Shipman et al., 2003; Zeman & Garber, 1996; Zeman & Shipman, 1996). For example, 6- to 12-year-old children express sadness to obtain comfort and prosocial behaviors from others, closer proximity to others, and the reinstatement of their internal goals (Jenkins & Ball, 2000; Stein & Jewett, 1986). Children also report expressing sadness because they: (a) expect a positive, supportive interpersonal response, (b) anticipate instrumental help after they disclose their sadness, and (c) perceive themselves as lacking skills to hide their sadness effectively (Zeman & Garber, 1996). Conversely, children may attempt to inhibit their sadness to avoid negative social interactions (Zeman & Garber, 1996). Collectively, these findings illustrate the growing salience of the social context (i.e., anticipated responses from others) on children's regulation decisions.

Adolescence The development of emotion regulation undergoes further transformation during adolescence as emotions are influenced by the unique developmental tasks of this period including developing autonomy, forging an identity, and obtaining a sense of belonging (Erikson, 1959). Consequently, adolescents' decisions to regulate emotions become more nuanced as they respond to the increasing complexity of their social environment (Zeman et al., 2006). Zimmerman and Iwanski (2014) found that adolescents' adaptive sadness regulation skills actually decrease during middle adolescence. These researchers studied youth's sadness regulation skills in early (11 and 13 years), middle (15 years), and late (17 and 19 years) adolescence and documented a decline from ages 13 to 15 years in social support seeking and adaptive sadness regulation. Moreover, passivity in response to sadness was high in early adolescence, later decreased in middle adolescence, and then increased in late adolescence. Additionally, avoidance strategies were reported more frequently in later adolescence and increased into adulthood. Suppression of emotion was cited as being utilized more frequently for sadness than anger but less often for fear. Lastly, the researchers noted that dysfunctional rumination and dysregulated expression are used significantly less frequently in sadness than anger and fear situations, with rumination

decreasing from adolescence into adulthood, but dysregulation increasing with age. According to Zimmerman and Iwanski (2014), these changes in methods of sadness regulation suggest that adolescents may be re-evaluating their childhood strategies for sadness experiences in response to their changing intrapersonal goals (e.g., identity questions) and interpersonal goals (e.g., fitting in with the peer group).

The role of emotion dynamics (e.g., intensity) in regulating emotion has also been examined in adolescents. Silk, Steinberg, and Morris (2003) studied 13-year-old adolescents' abilities to regulate sadness, anger, and worry of differing intensity and lability (i.e., the typical amount of emotion fluctuation) as well as the strategies they use to regulate these emotions (i.e., primary control, secondary control, disengagement, involuntary engagement). They found that adolescents who respond to negative events with disengagement (e.g., denial, avoidance, wishful thinking) and involuntary engagement (e.g., rumination, impulsive action) are more likely to have poor sadness regulation. However, there does not appear to be a link between adolescent use of primary control (e.g., problem solving, emotional expression) or secondary control (e.g., cognitive restructuring, acceptance) strategies and sadness regulation.

Child Gender

Research indicates that some aspects of sadness experience and management differ for boys and girls. For example, gender differences in how children express and regulate sadness are present during the preschool years. In a study examining 4-year-old children, girls express more submissive emotions (i.e., sadness, worry) than boys (Chaplin et al., 2005). Further, girls' submissive emotion expressions remain stable between 4 and 6 years of age, whereas expression of submissive emotions decreases by 50% for boys during that same period of time (Chaplin et al., 2005). Relatedly, Lindsey (2016) found that preschool girls who spend more time with same-gender peers show greater levels of sadness 1 year later, although this increase does not appear to be present for boys. This emerging difference in girls' and boys' sadness expressions may be a result of growing gender role pressures that arise during this developmental stage.

Gender differences in sadness regulation continue to become more pronounced during middle childhood. As young as 6 years old, boys attempt to suppress their sadness more than girls (Morelen, Zeman, Perry-Parrish, & Anderson, 2011; Zeman et al., 2006; Zeman & Garber, 1996). Given socialization pressures, boys may believe that expressing sadness is "unmanly," thereby contributing to a reluctance to show feelings of sadness (Brody, 2000; Morelen et al., 2011). Girls, in contrast, endorse being in less control of their sadness and expressing their sad feelings more overtly (e.g., crying) than boys (Morelen et al., 2011). Further, girls report feeling better when they express their sadness (Zeman & Shipman, 1996). These gender differences may be due to the greater social acceptability of sadness expression for girls compared to boys, and boys' fears of being teased or experiencing other negative interpersonal consequences following sadness displays (Zeman & Shipman, 1996, 1998).

The gender differences apparent in childhood persist as youth transition into adolescence. For example, in comparison to adolescent girls, boys report lower intensities for sadness than anger or fear throughout different scenarios (Zimmerman & Iwanski, 2014). Boys tend to minimize their sadness displays, are less liked by their peers for their overt sadness expressions, and have higher levels of parent-rated social problems than girls (Perry-Parrish & Zeman, 2011). In contrast, girls' sadness expressions do not predict peer acceptance or social dysfunction (Perry-Parrish & Zeman, 2011). Overall, girls tend to express their sadness more often than do boys, but their sadness expressions may also be viewed as more socially acceptable (Chaplin & Aldao, 2013).

Atypical Environments

Little research has examined the influence of atypical family contexts on adolescents' developing sadness regulation skills, with two exceptions. First, neighborhood violence negatively predicts

adolescent sadness regulation such that greater exposure to neighborhood violence is linked to poorer sadness regulation (Criss, Morris, Ponce-Garcia, Cui, & Silk, 2016). Second, for youth with a currently incarcerated mother, anger, but not sadness regulation, mediates the relation between incarceration-specific risk and internalizing and externalizing behaviors, such that greater incarceration-specific risk is associated with more psychological maladjustment through worse anger regulation (Zeman, Dallaire, Folk, & Thrash, 2018). These findings illustrate the need to examine sadness regulation skills that develop within unique social contexts, as the processes and mechanisms underlying regulatory efforts may operate differently.

In sum, children begin learning how to regulate their sadness at an early age, starting with self-soothing in infancy. The methods children use to manage their sadness develop in tandem with cognitive, social, and biological development, resulting in more sophisticated regulatory responses. Gender differences in these regulation patterns emerge early in life and strengthen depending on the gender norms of the children's social context. Sadness regulation skills are strongly influenced by socialization agents' messages about the acceptability of expressing sadness that are embedded in the broader cultural context. Perhaps one of the most critical influences of parental and peer sadness socialization is their link to psychosocial adaptation (for reviews, see Miller-Slough & Dunsmore, 2016; Zeman et al., 2013), a topic that is reviewed in the next section.

Psychosocial Adjustment Outcomes

One of the proposed mediators of the relation between sadness socialization and adjustment is children's sadness regulation, as socialization processes facilitate or impede children's learning of effective emotion regulation strategies (e.g., Cui, Morris, Criss, Houltberg, & Silk, 2014). There is considerable consistency across research studies to indicate that supportive parental responses typically lead to children's adaptive sadness management strategies that then protect against the development of psychosocial maladaptation (Cui et al., 2014). The following section reviews the extant literature to illustrate the nuances in these relations and specify the instances in which the associations are equivocal and need further investigation. We summarize research examining parental sadness expressivity, sadness discussions and responses, and sadness regulation as they relate to children's psychosocial outcomes, with a focus first on childhood and then adolescence. We then discuss the small corpus of research examining children's outcomes from peer sadness socialization.

Parental Sadness Socialization of Child-Age Offspring

Adjustment from Parental Sadness Expressivity

A body of research indicates that parental sadness expressivity is related to child adjustment, although fewer studies have examined adolescent outcomes (Bariola et al., 2011). Mothers' displays of heightened sadness correspond to increased distress in their infants, even when more regulated maternal behavior resumes (Cohn & Tronick, 1983). Further, toddlers whose mothers endorse a high level of sadness expressivity tend to exhibit less frequent self-soothing behaviors in both familiar and novel social contexts (Garner, 1995) and display lower levels of emotional understanding (i.e., explanatory emotion language, emotion regulation) in their daycare classroom (Denham et al., 1997; Denham, Zoller, & Couchoud, 1994).

In older children, exposure to heightened parental sadness expressivity has been implicated in children's poor self-image (Dunsmore, Bradburn, Costanzo, & Fredrickson, 2009), deficits in emotional competence (Camras et al., 1990), and impeded sympathy and prosocial behavior development (Eisenberg et al., 1992; Jones, Abbey, & Cumberland, 1998). High levels of parental sadness also relate to youths' emotion dysregulation, internalizing, and externalizing problems (Eisenberg et al., 2003; Raver &

Spagnola, 2002), as well as children's own heightened sadness expressions (Balswick & Avertt, 1977; Valiente, Eisenberg, et al. (2004)). Moreover, exposure to high levels of parental sadness expressivity may put children at risk for deleterious outcomes and can be exacerbated by parents' unsupportive responses (Dunsmore et al., 2009; Valiente, Eisenberg, et al., 2004). For example, when mothers who are high in sadness and fear expressivity respond to their children's failure to achieve with heightened sadness, youth rate themselves as less capable of achievement (Dunsmore et al., 2009). Some researchers propose that, similar to findings with younger samples, parents' heightened sadness expressivity is related to an increased vulnerability to internalizing disorders in adolescence (Brechwald & Prinstein, 2011). To this end, there is a sizeable body of research substantiating the link between parental depression and children's psychological outcomes (for reviews, see Beck, 1999; Cummings & Davies, 1994; Goodman & Gotlib, 1999; Goodman et al., 2011; Kane & Garber, 2004), although less research has assessed depressed parents' specific modeling of sadness expressivity and family emotional climate. In contrast, some research indicates that parents' sadness expressivity patterns may, in fact, not relate to children's emotion regulation, behavior problems, or social competence (Eisenberg et al., 2001; Valiente, Eisenberg, et al., 2004). Yet other findings point to a potentially adaptive function of parental sadness expressivity. For instance, Valiente, Eisenberg, et al. (2004) conclude that the constructive emotion coping behaviors of children from families moderate to high in sadness expressivity are less negatively affected by daily stress than children from less expressive families. More research is needed to clarify the direction of these effects given the equivocal findings across numerous studies.

Adjustment from Supportive Sadness Socialization

Starting in infancy, supportive parental responses to sadness displays provide the necessary scaffolding to facilitate attempts to self-soothe when distressed (Huebner & Izard, 1988; Malatesta & Haviland, 1982), whereas punitive and minimizing reactions contribute to toddlers' later internalizing behaviors (Luebbe et al., 2011). Interestingly, Luebbe et al. (2011) found that mothers who engage in higher levels of supportive *or* unsupportive reactions to their children's sadness and fear have toddlers who display more internalizing behaviors. Research is needed to delineate whether there is an optimal level and style of maternal supportiveness for very young children.

From early childhood onward, supportive caregiver responses to sadness aid children in maintaining positive expressivity, reducing negative affect, and learning adaptive ways to understand, regulate, and cope with emotions (Denham et al., 1994; Eisenberg et al., 1998; Garside, 2004; McElwain et al., 2007; Thompson & Meyer, 2007). Optimal parental responses also help youth express adaptive levels of sadness within their friendships and distinguish their feelings of sadness from other emotions (Denham et al., 1997). Children who perceive their parents as regularly rewarding their sadness expressions also report experiencing more overriding responses (Buckholdt et al., 2009; Garside, 2004; Tillery et al., 2015), suggesting that this combination of strategies may help children process their sadness.

Research indicates that supportive maternal responses in sadness discussions relate to fewer depressive symptoms in children through children's greater sadness coping (Tillery et al., 2015). Further, greater maternal awareness and acceptance of sadness has been found to promote children's emotion regulation skills that, in turn, contribute to fewer post-traumatic stress and depressive symptoms in children whose mothers are survivors of intimate partner violence (Katz, Stettler, & Gurtovenko, 2016). Fathers' supportive responses to children's sadness predict less internalizing symptomatology for both daughters and sons (Miller-Slough, Dunsmore, Zeman, Sanders, & Poon, 2018). Additionally, fathers' supportive responses are associated with daughters' lessened psychological distress as young adults (Garside, 2004). Finally, parental overriding of sadness during childhood corresponds to

fewer emotion dysregulation difficulties and self-harm behaviors in college-age students (Buckholdt et al., 2009).

Adjustment from Unsupportive Sadness Socialization

Unsupportive parental reactions amplify children's feelings of sadness (Denham et al., 1994), deter self-reflection of sadness states (Denham et al., 1997), and/or convey hopelessness to the child (Dunsmore et al., 2009). As such, parents' unsupportive reactions to sadness contribute to children's subsequent inhibition of sadness and emotion regulation difficulties (Buckholdt et al., 2009; Howard Sharp, Cohen, Kitzmann, & Parra, 2016; Raval & Martini, 2009), which exacerbate youths' risk for internalizing problems and social difficulties (e.g., Tillery et al., 2015). For example, high levels of parental unsupportive sadness responses, sadness dysregulation, and poor sadness regulation predict greater depressive symptomatology (Sanders et al., 2015).

Unfavorable outcomes have been identified with respect to parents' specific types of unsupportive responses to their children's sadness displays. Children who report that their parents punish and ignore their sadness have greater difficulties modifying and coping with their emotions, have less positive affect and positive expressivity, experience greater depressive symptomatology, and report more severity of self-harm (Buckholdt et al., 2009; Garside, 2004; Tillery et al., 2015). Greater maternal active discouragement and ignoring may also relate to children's greater loneliness and lower scores on several indices of social adjustment (i.e., classroom popularity, perceived social competence; Howard Sharp et al., 2016). Along these lines, parental hostility toward children's sadness expressions may elicit negative attitudes and fears about sad feelings, whereas parent indifference to or neglect of sadness may prompt worries about rejection (Boucher, Lecours, Philippe, & Arseneault, 2013). Paradoxically, parents who ignore children's expressions of sadness may inadvertently contribute to subsequent amplified sadness displays (Howard Sharp et al., 2016). Regarding parents' magnifying/distress-oriented responses, parental matching of youths' sadness is linked to children's emotion dysregulation (Buckholdt et al., 2009), depressive symptomatology (Tillery et al., 2015), and psychological distress (Garside & Klimes-Dougan, 2002).

Equivocal Findings Regarding Adjustment from Sadness Responses

A few studies suggest that supportive sadness responses, however, may not always be adaptive. For example, toddlers who are allowed to fully experience stressful, sadness-invoking situations, instead of being sheltered from these experiences by their caretakers, appear to develop adaptive sadness coping skills (Luebbe et al., 2011). Poon et al. (2017) suggest that the degree of adaptive parental supportive responses to sadness may differ for sons and daughters. Although mothers' emotion-coaching styles relate to girls' fewer internalizing and externalizing problems, results for boys yield a mixed pattern of benefits. Specifically, having parents who differ on their level of supportiveness and unsupportiveness (e.g., a mother low in emotion-coaching and a father high in emotion dismissing) is linked to boys' greater social competency when compared to boys with parents who are either highly supportive or unsupportive during sadness discussions (Poon et al., 2017). Researchers suggest that parents' socialization patterns should be studied as interacting influences, and the role of other socialization agents (e.g., peers) should be examined as they may buffer the effects of unsupportive parental emotional responses (Brody, 2000; Miller-Slough et al., 2018; Poon et al., 2017; Sanders et al., 2015).

Children raised in atypical environments may not benefit in the same way from strategies typically perceived as supportive for children raised in low-risk environments (Fabes et al., 2002). For example, in a sample of children with an incarcerated mother, Zeman et al. (2016) found that emotion-focused maternal responses to sadness are associated with children's poorer psychological and social functioning for those children exposed to high levels of incarcerated-specific risk factors. Problem-focused maternal

responses, in contrast, appear to be unrelated to psychosocial outcomes at high or low levels of incarceration-specific risk. These findings point to the importance of considering children's social context when evaluating the links between sadness socialization and psychological adaptation.

Adjustment from Sadness Regulation

Regarding the direct link between children's sadness regulation and outcomes, research indicates a positive relation between sadness regulation and psychosocial functioning (e.g., Folk, Zeman, Poon, & Dallaire, 2014; Sullivan, Helms, Kliewer, & Goodman, 2010; Zeman et al., 2002). For example, children's sadness dysregulation, as well as inhibition, predict internalizing symptoms both concurrently and longitudinally (Folk et al., 2014; Zeman et al., 2002). Poorer sadness regulation is linked to greater reluctance to express emotions, which is associated with more frequent forms of relational aggression (Sullivan et al., 2010). Additionally, Feng et al. (2009) found that for preadolescent girls, lower levels of sadness regulation directly relate to greater depressive symptoms, but only at low or average levels of maternal acceptance of emotion.

Parental Sadness Socialization of Adolescent-Age Offspring

Adjustment from Supportive Sadness Socialization

Concerning parental socialization of sadness in adolescence, adolescents report less depressive and anxious symptomatology when they perceive their mothers to be more supportive in their responses to and discussions of sadness (Hastings, Klimes-Dougan, Kendziora, Brand, & Zahn-Waxler, 2014). These findings build on notions that parental guidance during sadness discussions may aid depressed adolescents and adolescents at risk for internalizing problems to better identify, understand, and cope with sadness (Hunter et al., 2011). Miller-Slough and Dunsmore (2016) propose that overriding responses may be especially adaptive for adolescents because youth exhibit heightened levels of emotional reactivity during this developmental period.

Adjustment from Unsupportive Sadness Socialization

Unsupportive parental responses to adolescents' sadness are generally linked to maladaptive outcomes, although only a few studies have examined this association. When assessing global indices of supportive and unsupportive behaviors, Hastings et al. (2014) found that youth with mothers who engage in more punitive and less supportive responses to sadness and fear displays have greater internalizing symptomatology 2 years later, particularly for girls who show respiratory sinus arrhythmia augmentation in an initial assessment. Youth who report receiving frequent magnifying responses also have greater emotion dysregulation and disordered eating behaviors (Buckholdt et al., 2009; Hughes-Scalise & Connell, 2014). Parental reactionary distress may become a deterrent for adolescents to express their sadness, and/or this parental overemphasis on sadness may be interpreted as an invalidating response (Buckholdt et al., 2009).

Notably, some research indicates that not all supportive strategies have positive outcomes and not all unsupportive responses lead to deleterious consequences. For example, responsive and encouraging parental responses to sadness may inadvertently reinforce dysregulated sadness displays in depressed youth (Schwartz et al., 2012). Active discouragement of sadness displays (i.e., punishing) by parents, in contrast, may sometimes be adaptive as it can teach sadness inhibition skills that may generalize to the peer group, as sadness expressivity has been linked with less classroom popularity (Howard Sharp et al., 2016; Tillery et al., 2015). Likewise, some unsupportive parental responses may serve to convey the inappropriateness of excessive dysregulated affect and related behaviors (Schwartz et al., 2012). Clearly, more research is needed to delineate, under which situations certain parental socialization strategies lead to beneficial outcomes.

Adjustment from Sadness Regulation

Regarding the link between sadness regulation and psychosocial functioning, findings for adolescents mirror those with middle childhood samples. Research indicates that adolescents who acknowledge their sadness have increases in adaptive emotion coping skills over time (Zimmerman & Iwanski, 2014) and lower relational aggression (Sullivan et al., 2010), as well as greater social competence and higher social acceptance by same-sex peers (Perry-Parrish & Zeman, 2011). Further, there is a significant positive association between parents' reports of their daughters' social competence and the girls' frequent experiences of sadness (Perry-Parrish & Zeman, 2011).

Relatedly, research indicates that as adolescents' adaptive regulation strategies increase, their depressive symptoms decrease (Reindl, Gniewosz, & Reinders, 2016). Poor emotional awareness and inappropriate expression of sadness is related to more internalizing symptoms and externalizing behaviors in adolescents (Lougheed & Hollenstein, 2012; Silk et al., 2003). Teens who report more parental psychological control also exhibit greater depressive symptoms, especially adolescents who have difficulty regulating their sadness (Cui et al., 2014). Overall, managing sadness in a constructive manner is linked with positive outcomes, whereas poor sadness regulation tends to be indicative of psychological maladjustment.

Peer Sadness Socialization in Adolescence

Adjustment from Peer Sadness Socialization

Although the literature is limited with respect to studies examining the outcomes associated with peer sadness socialization, there is preliminary evidence to suggest that linkages are present. For example, within the context of adolescent friendships, dysregulated sadness displays may be internalized and subsequently imitated by friends, potentially putting them both at risk for increased internalizing symptomatology (Brechwald & Prinstein, 2011). On the other hand, youths with an emotionally supportive best friend tend to endorse greater social competence (Booth, Rubin, & Rose-Krasnor, 1998). Specifically, frequent rewarding types of sadness responses within the friendship are associated with greater sadness coping, less sadness dysregulation, and fewer depressive symptoms (Tillery et al., 2015). Best friend support of sadness displays also relates to youth's fewer depressive symptoms through their lessened sadness dysregulation (Tillery et al., 2015).

Regarding unsupportive responses, youth who provide punishing responses also endorse engaging in more magnifying reactions to their friends' sadness displays (Tillery et al., 2015). Within adolescent friendships, magnifying responses do not appear to function supportively, as these responses may promote ruminative dwelling on the negative affect, continued sad feelings (Rose et al., 2012), and greater externalizing symptomatology (Klimes-Dougan et al., 2014). Still, children's mildly unsupportive reactions to their friends' sadness displays may be unlikely to engender equally deleterious outcomes as those associated with parents' negative responses since friends' reactions may not increase arousal and childhood friends are mostly supportive counterparts (Denham, 2007; Sorber, 2001; Underwood, 1997). For example, Reindl et al. (2016) found that for sadness experiences, neither best friends' adaptive nor maladaptive emotion regulation strategies predict changes in adolescents' own emotion regulation strategies over time. Thus, the effect of peer versus parental sadness socialization may differ in the extent they influence adolescents' sadness regulation strategies.

Limitations and Future Directions

Since the onset of the "affect revolution" (Fischer & Tangney, 1995) in developmental psychology in the 1990s, a surge in research has focused on understanding how children, from infancy through adolescence, develop emotion regulation skills that are embedded within sociocultural

contexts (Adrian, Zeman, & Veits, 2011; Miller-Slough & Dunsmore, 2016; Zeman et al., 2013). A small fraction of this literature has examined discrete emotions (e.g., sadness, anger, worry), and as this review has exposed, there is only a small body of research that has focused specifically on youth's experience, regulation, and socialization of sadness. As such, there are many interesting and fruitful directions for future research that naturally arise from the gaps and shortcomings in the literature.

Role of Emotion Theory

Our review of the sadness development literature and interpretation of the findings are rooted within the functionalist theory of emotion (Barrett & Campos, 1987). Given that one's theoretical perspective guides the development of research questions, the methods chosen to address the questions, and interpretations of the results, it is important to acknowledge that different theories of emotion will emphasize particular aspects of sadness to study. At a very fundamental level, theories differ on the question of whether emotions can be identified into discrete categories or whether emotions only can be described using a dimensional approach (Davitz, 1969; Watson & Tellegen, 1985). Within the group of theories that views emotions as discrete entities (e.g., Ekman & Friesen, 1986), differences between these theories sometimes exist at the definitional level of what constitutes sadness and its action tendencies. For example, Lazarus (1991) asserts that sadness may reflect a mood state rather than a discrete emotion because its action tendency is inactivity (i.e., withdrawal) and the feeling state evolves slowly in response to the processing of the loss experience. These two aspects of sadness distinguish it from other negative emotions such as anger and worry (Lazarus, 1991). Another group of theorists posit that emotions are defined by the appraisal of the event that elicited the emotion (e.g., Roseman, 1984; Scherer, 1982) or that emotions are defined by particular patterns of appraisals (e.g., Smith & Ellsworth, 1987). Emotions are then defined by characteristics such as motivational state, agency, certainty, and valence, to name just a few (Roseman, Spindel, & Jose, 1990). It is beyond the scope of this review to articulate the ways in which specific emotion theories differ from one another. Nevertheless, each theory highlights or places emphasis on particular aspects of emotion development that provide the impetus for their investigations. Accordingly, researchers need to carefully articulate the important tenets of one's theoretical perspective that guide their investigations to provide definitional and interpretational clarity.

Examination of Discrete Emotions

From the functionalist perspective, it is important to examine discrete emotions, as each emotion is associated with unique goals, action tendencies, and outcomes (Barrett & Campos, 1987). There is now empirical support for the veracity of this supposition (e.g., Klimes-Dougan et al., 2014). An examination of the literature, however, indicates that individual negative emotions are often combined to form a negative emotion construct (e.g., Fabes et al., 2002; Watson, Clark, & Tellegen, 1988) or are referred to in non-specified ways (e.g., upset; Gratz & Roemer, 2004). Evidence has emerged to suggest that global or non-emotion-specific dysregulation is a transdiagnostic factor that underlies many forms of psychopathology in adulthood and adolescence (i.e., for a review, see Aldao, Gee, De Los Reyes, & Seager, 2016). Yet, this work has not yet examined how dysregulation of *specific* emotions may predict particular forms or aspects of psychopathology. Another line of research using primarily child samples provides evidence for the utility of adopting a more nuanced, emotion-specific approach (e.g., Edwards et al., 2005; Eisenberg et al., 1998; Folk et al., 2014; Morris et al., 2007; Suveg, Hoffman, Zeman, & Thomassin, 2009). Nonetheless, examining both individual emotions *and* global emotionality may provide important insights into the emotion processes being studied. The strengths and weaknesses of each approach should be acknowledged in inter-

pretations of research results. When assessing multiple emotions in one study, it may be helpful for researchers to first examine the associations among emotions, and then only combine discrete emotions into a global emotion score when there is statistical justification for doing so. Providing this information in the manuscript would also assist with comparisons across studies.

A second area concerning emotion specificity that has been overlooked is the nature of experiencing mixed or simultaneous emotions (Harter & Buddin, 1987). For younger children, identifying only one predominant emotion for a situation is normative and reflects their level of cognitive development that places limits on their emotional understanding. However, for older children (i.e., 10 years of age and older) who have more advanced cognitive skills, an understanding that one can simultaneously experience more than one emotion of similar valence (e.g., anger, sadness) or different valence (e.g., sadness, happiness) is developmentally appropriate (Harter & Buddin, 1987). Thus, this aspect of emotion development should be considered when examining sadness regulation and socialization processes; the links to adjustment may differ depending on whether sadness is truly the predominant affective experience or if it is experienced as a blend with another emotion.

Socialization Agents

Although parents are considered to be the primary emotion socializing agents in childhood (Saarni, 1999), there are other individuals in children's and adolescents' lives who exert socializing influences on youth's emotion regulation. The recent interest in friend emotion socialization provides preliminary evidence for the value of including an array of socialization agents in emotion research (Miller-Slough & Dunsmore, 2016). For example, immediate and extended family members, the broader peer group, authority figures (e.g., teachers, coaches, religious leaders), and media figures are just a few examples of the many external forces that may influence youth's emotional development.

Regarding the investigation of parental sadness socialization, the role of the socialization agent and the amount of "socializing time" each figure has with the target child should be considered. Rather than examining sadness socialization based solely on parent biological sex (i.e., father versus mother), it may be instructive to determine the types of activities and responsibilities each parent assumes. Relatedly, the type of family composition (e.g., same-gender parents, blended family, alternative family structures, military family with a parent deployed) needs to be considered, as this variable may influence sadness socialization processes (Sanders et al., 2015). The role of siblings in emotion socialization has been understudied, yet this category of socialization agent is unique as a sibling provides aspects of both a peer relationship (depending on the age spacing) and that of a hierarchical relationship**.** Much of the parental sadness socialization research has examined dyadic interactions between parents and children, yet emotion socialization processes typically occur within a larger family context of mothers, fathers, siblings, and others. Thus, capturing the complexity of multiple socialization agents within one environmental context may provide a more ecologically valid representation of the dynamic, transactional socialization processes at play.

Regarding friend socialization of sadness, it is important to consider different facets of friendships including the quality of the friendship, the length of time the adolescents have been friends, the amount of time they spend together, and the contexts in which their encounters occur. Currently, research has utilized samples of same-gender friend dyads (e.g., Borowski, Zeman, & Braunstein, 2018; Miller-Slough & Dunsmore, 2016), but it would be interesting to understand if sadness socialization differs in mixed-gender friendships, romantic relationships, and mixed-age dyads. Also, the type of sadness socialization that occurs within small groups of three or four close friends (i.e., cliques) may provide unique insights into how youths learn to regulate their sadness and other emotions flexibly in response to the expression norms of their particular peer

context. The use of social media (e.g., Facebook, Instagram) in friendships may influence sadness communication, but this new way of interacting has not yet been examined in relation to emotion regulation and socialization. Perhaps the use of sad emoticons in a text message is a new way for youth to indirectly express sadness in order to safely test their friend's reception to their sadness disclosure.

Finally, because most research has been conducted using cross-sectional designs, we do not know whether there is a particular developmental period in which sadness socialization is the most salient to emotion regulation development. For example, although friend socialization of emotion appears to be particularly relevant in adolescence, it is not the case that parental sadness socialization influences are dormant during this period (Miller-Slough & Dunsmore, 2016). Along these lines, the interactions between different socialization influences (e.g., parents and best friends) would be interesting to examine, particularly when the socialization messages present opposing views.

Role of Culture

Research investigating children's sadness regulation and socialization reflects the general trend in emotional development research in which participants are primarily recruited from European American, middle-class samples. However, cultural norms for sadness expression within and outside the United States differ as a function of demographic variables as well as broader cultural norms (Cole, Tamang, & Shrestha, 2006; Mesquita & Frijda, 1992). Emotion socialization research has framed its questions, methods, and interpretations of data to reflect Western culture individualist emotion competence norms that emphasize development of children's autonomy, rather than relational emotional competence norms that foster emotional development within an interdependent familial context (Friedlmeier et al., 2011). Thus, variations in emotion socialization practices can be expected between cultures.

Within the United States, for example, a corpus of research indicates that unsupportive parental emotion socialization patterns are associated with greater adjustment difficulties for European American than African American young adults (e.g., Dunbar, Perry, Cavanaugh, & Leerkes, 2015; Leerkes, Supple, Su, & Cavanaugh, 2015), and that suppression of negative emotion may be more adaptive for African American than European American young adults (Cole & Tan, 2007). Further, some strategies (i.e., expressive encouragement) considered supportive for European American children are associated with lower academic competence for African American children of kindergarten age (Nelson et al., 2013). Unfortunately, the role of sadness in this body of research has not been examined. There is likely a wide range of cultural norms for the expression of sadness, perhaps because the display of sadness may be more difficult to discern by others in contrast to externalizing types of emotions such as anger.

Little research has investigated cross-national comparisons in children's emotion expressivity, socialization, and regulation, particularly for sadness, with a few exceptions. Morelen et al. (2011) found that children from the United States report more inhibition of sadness than children from Ghana and Kenya. However, similarities between nations were also found such that regardless of nationality, girls report expressing sadness more frequently than do boys. Raval, Martini, and Raval (2007) interviewed Hindu upper-caste, Gujarati Indian children who reported that they are more likely to suppress expressions of sadness and anger than physical pain. In a subsequent study (Raval & Martini, 2009), Gujarati children's methods and reasons for regulating sadness, anger, and physical pain were investigated in groups of children who were identified as experiencing externalizing, internalizing, or somatic symptoms. The findings for sadness regulation showed both patterns of similarities and differences in relation to the other psychopathology groups and to Caucasian samples from the United States. Thus, there is considerable need for future research that examines cultural differences to not only document the within-nation and

across-nation differences, but also further investigate *why* these differences exist and how they relate to adjustment (Cole et al., 2006).

Methodological Issues

Although shortcomings and challenges to conducting emotion research with children and adolescence have been discussed elsewhere (e.g., Zeman, Klimes-Dougan, Cassano, & Adrian, 2007), it is important to highlight a few areas that may be unique to developmental research examining sadness. Given the potentially private nature of sadness experience and the cultural sanctions against displaying vulnerable emotions such as sadness, particularly for boys, obtaining reliable and valid indicators of sadness poses challenges. With increasing age, children become more adept at dissembling sadness, which creates difficulties for reporters (e.g., parents, teachers) to provide accurate portrayals of the youth's sadness. Further, in adolescence, the use of observational methods in which sadness is evoked become less tenable as youth are better able to skillfully manage their sadness displays. Thus, the methods used to evaluate sadness regulation and socialization become more reliant on older children's and adolescents' willingness to convey their honest perceptions and accurate self-evaluations. One method that may counter some of these issues is to track children and adolescents' emotional experiences in real time using electronic diaries (Jobe-Shields et al., 2014; Suveg, Payne, Thomassin, & Jacob, 2010; Whalen et al., 2006). This method has been found useful for data collection as well as a method of intervention to process emotion (Thomassin, Morelen, & Suveg, 2012). These types of creative methods may be helpful tools for understanding the continued development of sadness regulation and socialization as children enter adolescence and beyond.

The use of multiple reporters of children's sadness experience and perceptions of socialization responses is essential in order to develop a more complete understanding of the processes under study. Obtaining multiple measures of a construct permits more sophisticated analyses including confirmatory factor analyses and structural equation modeling, both of which will help to elucidate the relations among variables in a more nuanced manner.

Another area that requires more investigation is the reciprocal influence between the child and socialization agent (e.g., parent, friend) on sadness socialization. Given that sadness socialization is a dynamic process in which both parties contribute to the interaction (Fogel, Nwokah, Dedo, & Messenger, 1992; Premo & Kiel, 2014), it is important to use methods that capture this transactional process. Some research has used sequential analyses to examine the bidirectional relations in parent-child emotion interactions (Morelen & Suveg, 2012).

Conclusion

As evident in this review of the literature, the study of normative sadness in children and adolescents is an important area of inquiry given the pervasiveness of sadness in human existence. Experiences of loss elicit feelings of sadness routinely, and thus, children must learn how to respond to this emotional arousal in adaptive ways. Parents and peers are two types of socialization agents who impart significant influence on the reasons and methods children use to manage their sadness experience and expression. Different socialization responses lead to a variety of positive and negative outcomes that interact with child-level and parent-level factors as well as with broader cultural emotion norms. Although there is a growing body of research examining youth's sadness, there remain many unanswered questions. We hope that this review will serve as a launching pad that inspires creative inquiry into children and adolescents' sadness.

References

Adams, S., Kuebli, J., Boyle, P. A., & Fivush, R. (1995). Gender differences in parent-child conversations about past emotions: A longitudinal investigation. *Sex Roles, 33*(5–6), 309–323. https://doi.org/10.1007/BF01954572

Adrian, M., Zeman, J., & Veits, G. (2011). Methodological implications of the affect revolution: A 35-year review of emotion regulation assessment in children. *Journal of Experimental Child Psychology, 110*(2), 171–197. https://doi.org/10.1016/j.jecp.2011.03.009

Aldao, A., Gee, D., De Los Reyes, A., & Seager, I. (2016). Emotion regulation as a transdiagnostic factor in the development of internalizing and externalizing psychopathology: Current and future directions. *Development and Psychopathology, 28*(4), 927–946. https://doi.org/10.1017/S0954579416000638

Aldrich, N. J., & Tenenbaum, H. R. (2006). Sadness, anger, and frustration: Gendered patterns in early adolescents' and their parents' emotion talk. *Sex Roles, 55*(11–12), 775–785. https://doi.org/10.1007/s11199-006-9131-y

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5*. Arlington, VA: Author.

Balswick, J., & Avertt, C. P. (1977). Differences in expressiveness: Gender, interpersonal orientation, and perceived parental expressiveness as contributing factors. *Journal of Marriage and Family, 39*(1), 121–127. https://doi.org/10.2307/351068

Bariola, E., Gullone, E., & Hughes, E. K. (2011). Child and adolescent emotion regulation: The role of parental emotion regulation and expression. *Clinical Child and Family Psychology Review, 14*(2), 198–212. https://doi.org/10.1007/s10567-011-0092-5

Barrett, K., & Campos, J. (1987). Perspectives on emotional development II: A functionalist approach to emotions. In J. Osofsky (Ed.), *Handbook of infant development* (2nd ed., pp. 555–578). New York, NY: Wiley.

Beck, C. T. (1999). Maternal depression and child behaviour problems: A meta-analysis. *Journal of Advanced Nursing, 29*(3), 623–629. https://doi.org/10.1046/j.1365-2648.1999.00943.x

Block, J. H. (1983). Differential premises arising from differential socialization of the sexes: Some conjectures. *Child Development, 54*(6), 1335–1354. https://doi.org/10.2307/1129799

Booth, C. L., Rubin, K. H., & Rose-Krasnor, L. (1998). Perceptions of emotional support from mother and friend in middle childhood: Links with social-emotional adaptation and preschool attachment security. *Child Development, 69*(2), 427–442. https://doi.org/10.1111/j.1467-8624.1998.tb06200.x

Borowski, S., Zeman, J., & Braunstein, K. (2018). Social anxiety and socioemotional functioning during early adolescence: The mediating role of best friend emotion socialization. *Journal of Early Adolescence, 38*, 238–260.

Boucher, M. E., Lecours, S., Philippe, F. L., & Arseneault, S. (2013). Parental socialization of emotion and depression in adulthood: The role of attitudes toward sadness. *European Review of Applied Psychology, 63*(1), 15–23. https://doi.org/10.1016/j.erap.2012.11.003

Brand, A. E., & Klimes-Dougan, B. (2010). Emotion socialization in adolescence: The roles of mothers and fathers. *New Directions for Child and Adolescent Development, 2010*(128), 85–100. https://doi.org/10.1002/cd.270

Brechwald, W. A., & Prinstein, M. J. (2011). Beyond homophily: A decade of advances in understanding peer influence processes. *Journal of Research on Adolescence, 21*(1), 166–179. https://doi.org/10.1111/j.1532-7795.2010.00721.x

Brody, L. R. (2000). The socialization of gender differences in emotional expression: Display rules, infant temperament, and differentiation. In A. Fischer (Ed.), *Gender and emotion: Social psychological perspectives* (pp. 24–47). Cambridge, UK: Cambridge University Press.

Buckholdt, K. E., Kitzmann, K. M., & Cohen, R. (2016). Parent emotion coaching buffers the psychological effects of poor peer relations in the classroom. *Journal of Social and Personal Relationships, 33*(1), 23–41. https://doi.org/10.1177/0265407514562560

Buckholdt, K. E., Parra, G. R., & Jobe-Shields, L. (2009). Emotion regulation as a mediator of the relation between emotion socialization and deliberate self-harm. *American Journal of Orthopsychiatry, 79*(4), 482–490. https://doi.org/10.1037/a0016735

Buss, K. A., & Kiel, E. J. (2004). Comparison of sadness, anger, and fear facial expressions when toddlers look at their mothers. *Child Development, 75*(6), 1761–1773. https://doi.org/10.1111/j.1467-8624.2004.00815.x

Calkins, S. D., & Hill, A. (2007). Caregiver influences on emerging emotion regulation: Biological and environmental transactions in early development. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 229–248). New York, NY: Guilford Press.

Campos, J. J. (1982). Human emotions: Their new importance and their role in social referencing. *Research and Clinical Center for Child Development, 4*, 1–7.

Campos, J. J., Campos, R. G., & Barrett, K. C. (1989). Emergent themes in the study of emotional development and emotion regulation. *Developmental Psychology, 25*(3), 394–402. https://doi.org/10.1037/0012-1649.25.3.394

Camras, L. A. (1982). Ethological approaches to nonverbal communication. In R. S. Feldman (Ed.), *Development of nonverbal communication* (pp. 3–28). New York, NY: Springer.

Camras, L. A., Malatesta, C., & Izard, C. E. (1991). The development of facial expressions in infancy. In R. S. Feldman & B. Rimé (Eds.), *Studies in emotion & social interaction: Fundamentals of nonverbal behavior* (pp. 73–105). New York, NY: Cambridge University Press.

Camras, L. A., Ribordy, S., Hill, J., Martino, S., Sachs, V., Spaccarelli, S., & Stefani, R. (1990). Maternal facial behavior and the recognition and production of emotional expression by maltreated and nonmaltreated children. *Developmental Psychology, 26*(2), 304–312. https://doi.org/10.1037/0012-1649.26.2.304

Casey, R. J., & Fuller, L. L. (1994). Maternal regulation of children's emotions. *Journal of Nonverbal Behavior, 18*(1), 57–89. https://doi.org/10.1007/BF02169079

Cassano, M., Perry-Parrish, C., & Zeman, J. (2007). Influence of gender on parental socialization of children's sadness regulation. *Social Development, 16*(2), 210–231. https://doi.org/10.1111/j.1467-9507.2007.00381.x

Cassano, M. C., & Zeman, J. L. (2010). Parental socialization of sadness regulation in middle childhood: The role of expectations and gender. *Developmental Psychology, 46*(5), 1214–1226. https://doi.org/10.1037/a0019851

Cassano, M. C., Zeman, J. L., & Sanders, W. M. (2014). Responses to children's sadness: Mothers' and fathers' unique contributions and perceptions. *Merrill-Palmer Quarterly, 60*(1), 1–23. https://doi.org/10.1353/mpq.2014.0004

Chaplin, T. M., & Aldao, A. (2013). Gender differences in emotion expression in children: A meta-analytic review. *Psychological Bulletin, 39*(4), 735–765. https://doi.org/10.1037/10030737

Chaplin, T. M., Cole, P. M., & Zahn-Waxler, C. (2005). Parental socialization of emotion expression: Gender differences and relations to child adjustment. *Emotion, 5*(1), 80–88. https://doi.org/10.1037/1528-3542.5.1.80

Chiarella, S. S., & Poulin-Dubois, D. (2015). "Aren't you supposed to be sad?" Infants do not treat a stoic person as an unreliable emoter. *Infant Behavior and Development, 38*, 57–66. https://doi.org/10.1016/j.infbeh.2014.12.007

Cohn, J. F., & Tronick, E. Z. (1983). Three-month-old infants' reaction to simulated maternal depression. *Child Development, 54*(1), 185–193. https://doi.org/10.2307/1129876

Cole, P., Tamang, B., & Shrestha, S. (2006). Cultural variations in the socialization of children's anger and shame. *Child Development, 77*(5), 1237–1251. https://doi.org/10.1111/j.1467-8624.2006.00931

Cole, P. M., Dennis, T. A., Smith-Simon, K. E., & Cohen, L. H. (2009). Preschoolers' emotion regulation strategy understanding: Relations with emotion socialization and child self-regulation. *Social Development, 18*(2), 324–352. https://doi.org/10.1111/j.1467-9507.2008.00503.x

Cole, P. M., & Tan, P. Z. (2007). Emotion socialization from a cultural perspective. In J. E. Grusec & P. D. Hastings (Eds.), *Handbook of socialization: Theory and research* (pp. 516–542). New York, NY: Guilford Press.

Conway, C. C., Rancourt, D., Adelman, C. B., Burk, W. J., & Prinstein, M. J. (2011). Depression socialization within friendship groups at the transition to adolescence: The roles of gender and group centrality as moderators of peer influence. *Journal of Abnormal Psychology, 120*(4), 857–867. https://doi.org/10.1037/a0024779

Criss, M. M., Morris, A. S., Ponce-Garcia, E., Cui, L., & Silk, J. S. (2016). Pathways to adaptive emotion regulation among adolescents from low-income families. *Family Relations, 65*(3), 517–529. https://doi.org/10.1111/fare.12202

Crockenberg, S. C., & Leerkes, E. M. (2004). Infant and maternal behaviors regulate infant reactivity to novelty at 6 months. *Developmental Psychology, 40*(6), 1123–1132. https://doi.org/10.1037/0012-1649.40.6.1123

Cui, L., Morris, A., Criss, M., Houltberg, B., & Silk, J. (2014). Parental psychological control and adolescent adjustment: The role of adolescent emotion regulation. *Parenting: Science and Practice, 14*(1), 47–67. https://doi.org/10.1080/15295192.2014.880018

Cummings, E. M., & Davies, P. T. (1994). Maternal depression and child development. *Journal of Child Psychology and Psychiatry, 35*(1), 73–122. https://doi.org/10.1111/j.1469-7610.1994.tb01133.x

Davis, E. L. (2016). An age-related mechanism of emotion regulation: Regulating sadness promotes children's learning by broadening information processing. *Child Development, 87*(5), 1617–1626. https://doi.org/10.1111/cdev.12552

Davis, E. L., Quiñones-Camacho, L. E., & Buss, K. A. (2016). The effects of distraction and reappraisal on children's parasympathetic regulation of sadness and fear. *Journal of Experimental Child Psychology, 142*, 344–358. https://doi.org/10.1016/j.jecp.2015.09.020

Davitz, J. R. (1969). *The language of emotion*. San Diego, CA: Academic Press.

Deater-Deckard, K. (2001). Annotation: Recent research examining the role of peer relationships in the development of psychopathology. *The Journal of Child Psychology and Psychiatry and Allied Disciplines, 42*(5), 565–579. https://doi.org/10.1017/S0021963001007272

Denham, S., & Kochanoff, A. T. (2002). Parental contributions to preschoolers' understanding of emotion. *Marriage & Family Review, 34*(3–4), 311–343. https://doi.org/10.1300/J002v34n03_06

Denham, S. A. (1998). *Emotional development in young children*. New York, NY: Guilford Press.

Denham, S. A. (2007). Dealing with feelings: How children negotiate the worlds of emotions and social relationships. *Cognition, Brain, & Behavior, 11*(1), 1–48.

Denham, S. A., Mitchell-Copeland, J., Strandberg, K., Auerbach, S., & Blair, K. (1997). Parental contributions to preschoolers' emotional competence: Direct and indirect effects. *Motivation and Emotion, 21*(1), 65–86. https://doi.org/10.1023/A:1024426431247

Denham, S. A., Zoller, D., & Couchoud, E. A. (1994). Socialization of preschoolers' emotion understanding. *Developmental Psychology, 30*(6), 928–936. https://doi.org/10.1037/0012-1649.30.6.928

Dunbar, A., Perry, N., Cavanaugh, A., & Leerkes, E. (2015). African American parents' racial and emotion socialization profiles and young adults' emotional adaptation. *Cultural Diversity and Ethnic Minority Psychology, 21*(3), 409–419. https://doi.org/10.1037/a0037546

Dunsmore, J. C., Bradburn, I. S., Costanzo, P. R., & Fredrickson, B. L. (2009). Mothers' expressive style and emotional responses to children's behavior predict children's prosocial and achievement-

related self-ratings. *International Journal of Behavioral Development, 33*(3), 253–264. https://doi.org/10.1177/0165025408098025

Edwards, A., Shipman, K., & Brown, A. (2005). The socialization of emotional understanding: A comparison of neglectful and nonneglectful mothers and their children. *Child Maltreatment, 10*(3), 293–304. https://doi.org/10.1177/1077559505278452

Eisenberg, N., Cumberland, A., & Spinrad, T. L. (1998). Parental socialization of emotion. *Psychological Inquiry, 9*(4), 241–273. https://doi.org/10.1207/s15327965pli0904_1

Eisenberg, N., Fabes, R. A., Carlo, G., Troyer, D., Speer, A. L., Karbon, M., & Switzer, G. (1992). The relations of maternal practices and characteristics to children's vicarious emotional responsiveness. *Child Development, 63*(3), 583–602. https://doi.org/10.1111/j.1467-8624.1992.tb01648.x

Eisenberg, N., Gershoff, E. T., Fabes, R. A., Shepard, S. A., Cumberland, A. J., Losoya, S. H., … Murphy, B. C. (2001). Mother's emotional expressivity and children's behavior problems and social competence: Mediation through children's regulation. *Developmental Psychology, 37*(4), 475–490. https://doi.org/10.1037/0012-1649.37.4.475

Eisenberg, N., Valiente, C., Morris, A. S., Fabes, R. A., Cumberland, A., Reiser, M., … Losoya, S. (2003). Longitudinal relations among parental emotional expressivity, children's regulation, and quality of socioemotional functioning. *Developmental Psychology, 39*(1), 3–19. https://doi.org/10.1037/0012-1649.39.1.3

Ekman, P. (1992). Are there basic emotions? *Psychological Review, 99*(3), 550–553. https://doi.org/10.1037/0033-295X.99.3.550

Ekman, P., & Friesen, W. (1986). A new pan-cultural facial expression of emotion. *Motivation and Emotion, 10*, 159–168.

Erikson, E. H. (1959). Identity and the life cycle. *Psychological Issues, 1*, 1–171.

Ersay, E. (2014). Parental socialization of emotion: How mothers respond to their children's emotions in Turkey. *International Journal of Emotional Education, 6*(1), 33–46.

Fabes, R. A., & Martin, C. L. (1991). Gender and age stereotypes of emotionality. *Personality and Social Psychology Bulletin, 17*(5), 532–540. https://doi.org/10.1177/0146167291175008

Fabes, R. A., Poulin, R. E., Eisenberg, N., & Madden-Derdich, D. A. (2002). The coping with children's negative emotions scale (CCNES): Psychometric properties and relations with children's emotional competence. *Marriage & Family Review, 34*(3–4), 285–310. https://doi.org/10.1300/J002v34n03_05

Fava, M., Hwang, I., Rush, A. J., Sampson, N., Walters, E. E., & Kessler, R. C. (2010). The importance of irritability as a symptom of major depressive disorder: Results from the National Comorbidity Survey Replication. *Molecular Psychiatry, 15*(8), 856–867. https://doi.org/10.1038/mp.2009.20

Feng, X., Keenan, K., Hipwell, A. E., Henneberger, A. K., Rischall, M. S., Butch, J., … Babinski, D. E. (2009). Longitudinal associations between emotion regulation and depression in preadolescent girls: Moderation by the caregiving environment. *Developmental Psychology, 45*(3), 798–808. https://doi.org/10.1037/a0014617

Fischer, K., & Tangney, J. (1995). Self-conscious emotions and the affect revolution: Framework and overview. In J. P. Tangney & K. W. Fischer (Eds.), *Self-conscious emotions: The psychology of shame, guilt, embarrassment, and pride*. New York, NY: Guilford Press.

Fivush, R. (1989). Exploring sex differences in the emotional content of mother-child conversations about the past. *Sex Roles, 20*(11–12), 675–691. https://doi.org/10.1007/BF00288079

Fivush, R. (1991). Gender and emotion in mother-child conversations about the past. *Journal of Narrative and Life History, 1*(4), 325–341. https://doi.org/10.1075/jnlh.1.4.04gen

Fivush, R., Brotman, M. A., Buckner, J. P., & Goodman, S. H. (2000). Gender differences in parent-child emotion narratives. *Sex Roles, 42*(3–4), 233–253. https://doi.org/10.1023/A:1007091207068

Fogel, A., Nwokah, E., Dedo, J., & Messenger, D. (1992). Social process theory of emotion: A dynamic systems approach. *Social Development, 1*(1), 122–142. https://doi.org/10.1023/A:1007091207068

Folk, J. B., Zeman, J. L., Poon, J. A., & Dallaire, D. H. (2014). A longitudinal examination of emotion regulation: Pathways to anxiety and depressive symptoms in urban minority youth. *Child and Adolescent Mental Health, 19*(4), 243–250. https://doi.org/10.1111/camh.12058

Franko, D. L., Powers, T. A., Zuroff, D. C., & Moskowitz, D. S. (1985). Children and affect: Strategies for self-regulation and sex differences in sadness. *American Journal of Orthopsychiatry, 55*(2), 210–219. https://doi.org/10.1111/j.1939-0025.1985.tb03435.x

Friedlmeier, W., Corapci, F., & Cole, P. (2011). Emotion socialization in cross-cultural perspective. *Social and Personality Psychology Compass, 5*(7), 410–427. https://doi.org/10.1111/j.1751-9004.2011.00362.x

Fuchs, D., & Thelen, M. H. (1988). Children's expected interpersonal consequences of communicating their affective state and reported likelihood of expression. *Child Development, 59*(5), 1314–1322. https://doi.org/10.2307/1130494

Garner, P. W. (1995). Toddlers' emotion regulation behaviors: The roles of social context and family expressiveness. *The Journal of Genetic Psychology, 156*(4), 417–430. https://doi.org/10.1080/00221325.1995.9914834

Garside, R. B. (2004). *Parental socialization of discrete positive and negative emotions: Implications for emotional functioning* (Unpublished doctoral dissertation). The Catholic University of America, Washington, DC.

Garside, R. B., & Klimes-Dougan, B. (2002). Socialization of discrete negative emotions: Gender differences and

links with psychological distress. *Sex Roles, 47*(3–4), 115–128. https://doi.org/10.1023/A:1021090904785

Gartstein, M. S., & Rothbart, M. K. (2003). Studying infant temperament via the revised infant behavior questionnaire. *Infant Behavior and Development, 26*(1), 64–86. https://doi.org/10.1016/S0163-6383(02)00169-8

Goodman, S. H., & Gotlib, I. H. (1999). Risk for psychopathology in the children of depressed mothers: A developmental model for understanding mechanisms of transmission. *Psychological Review, 106*(3), 458–490. https://doi.org/10.1037/0033-295X.106.3.458

Goodman, S. H., Rouse, M. H., Connell, A. M., Broth, M. R., Hall, C. M., & Heyward, D. (2011). Maternal depression and child psychopathology: A meta-analytic review. *Clinical Child and Family Psychology Review, 14*(1), 1–27. https://doi.org/10.1007/s10567-010-0080-1

Gottman, J. M., Katz, L. F., & Hooven, C. (1997). *Meta-emotion: How families communicate emotionally*. Mahwah, NJ: Lawrence Erlbaum Associates.

Gratz, K. L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the difficulties in emotion regulation scale. *Journal of Psychopathology and Behavioral Assessment, 26*(1), 41–54. https://doi.org/10.1023/B:JOBA.0000007455.08539.94

Green, J. A., Whitney, P. G., & Potegal, M. (2011). Screaming, yelling, whining, and crying: Categorical and intensity differences in vocal expressions of anger and sadness in children's tantrums. *Emotion, 11*(5), 1124–1133. https://doi.org/10.1037/a0024173

Gross, J. J., Sheppes, G., & Urry, H. L. (2011). Emotion generation and emotion regulation: A distinction we should make (carefully). *Cognition & Emotion, 25*(5), 765–781. https://doi.org/10.1080/02699931.2011.555753

Halberstadt, A. G., Cassidy, J., Stifter, C. A., Parke, R. D., & Fox, N. A. (1995). Self-expressiveness within the family context: Psychometric support for a new measure. *Psychological Assessment, 7*(1), 93–103. https://doi.org/10.1037/1040-3590.7.1.93

Halberstadt, A. G., Crisp, V. W., & Eaton, K. L. (1999). Family expressiveness: A retrospective and new directions for research. In P. Philippot, R. S. Feldman, & E. J. Coats (Eds.), *Studies in emotion and social interaction: The social context of nonverbal behavior* (pp. 109–155). New York, NY: Cambridge University Press.

Halberstadt, A. G., & Eaton, K. L. (2002). A meta-analysis of family expressiveness and children's emotion expressiveness and understanding. *Marriage & Family Review, 34*(1–2), 35–62. https://doi.org/10.1300/J002v34n01_03

Harter, S., & Buddin, B. J. (1987). Children's understanding of the simultaneity of two emotions: A five-stage developmental acquisition sequence. *Developmental Psychology, 23*(3), 388–399. https://doi.org/10.1037/0012-1649.23.3.388

Hastings, P. D., Klimes-Dougan, B., Kendziora, K. T., Brand, A., & Zahn-Waxler, C. (2014). Regulating sadness and fear from outside and within: Mothers' emotion socialization and adolescents' parasympathetic regulation predict the development of internalizing difficulties. *Development and Psychopathology, 26*(4), 1369–1384. https://doi.org/10.1017/S0954579414001084

Haviland, J. M., & Lelwica, M. (1987). The induced affect response: 10-week-old infants' responses to three emotion expressions. *Developmental Psychology, 23*(1), 97–104. https://doi.org/10.1037/0012-1649.23.1.97

Heck, A. R., Panneton, R. K., & Mills-Smith, L. (2016). Bimodal dynamics of faces and voices influence older infants' perception of emotion. *Infancy, 21*(4), 522–531. https://doi.org/10.1111/infa.12121

Hooven, C., Gottman, J. M., & Katz, L. F. (1995). Parental meta-emotion structure predicts family and child outcomes. *Cognition and Emotion, 9*(2–3), 229–264. https://doi.org/10.1080/02699939508409010

Howard Sharp, K. M. H., Cohen, R., Kitzmann, K. M., & Parra, G. R. (2016). Mechanisms mediating children's perceived maternal nonsupportive reactions to sadness and children's social and emotional functioning. *Journal of Child and Family Studies, 25*(2), 367–380. https://doi.org/10.1007/s10826-015-0240-5

Huebner, R. R., & Izard, C. E. (1988). Mothers' responses to infants' facial expressions of sadness, anger, and physical distress. *Motivation and Emotion, 12*(2), 185–196. https://doi.org/10.1007/BF00992173

Hughes-Scalise, A., & Connell, A. (2014). The roles of adolescent attentional bias and parental invalidation of sadness in significant illness: A comparison between eating disorders and chronic pain. *Eating Behaviors, 15*(3), 493–501. https://doi.org/10.1016/j.eatbeh.2014.06.007

Hunter, E. C., Katz, L. F., Shortt, J. W., Davis, B., Leve, C., Allen, N. B., & Sheeber, L. B. (2011). How do I feel about feelings? Emotion socialization in families of depressed and healthy adolescents. *Journal of Youth and Adolescence, 40*(4), 428–441. https://doi.org/10.1007/s10964-010-9545-2

Hutt, R. L., Buss, K. A., & Kiel, E. J. (2013). Caregiver protective behavior, toddler fear and sadness, and toddler cortisol reactivity in novel contexts. *Infancy, 18*(5), 708–728. https://doi.org/10.1111/j.1532-7078.2012.00141.x

Hyson, M. C., & Izard, C. E. (1985). Continuities and changes in emotion expressions during brief separation at 13 and 18 months. *Developmental Psychology, 21*(6), 1165–1170. https://doi.org/10.1037/0012-1649.21.6.1165

Jenkins, J. M., & Ball, S. (2000). Distinguishing between negative emotions: Children's understanding of the social-regulatory aspects of emotion. *Cognition and Emotion, 14*(2), 261–282. https://doi.org/10.1080/026999300378969

Jobe-Shields, L., Parra, G. R., Buckholdt, K. E., & Tillery, R. N. (2014). Adolescent reactions to maternal responsiveness and internalizing symptomatology: A daily

diary investigation. *Personal Relationships, 21*(2), 335–348. https://doi.org/10.1111/pere.12034

Jones, D. C., Abbey, B. B., & Cumberland, A. (1998). The development of display rule knowledge: Linkages with family expressiveness and social competence. *Child Development, 69*(4), 1209–1222. https://doi.org/10.1111/j.1467-8624.1998.tb06168.x

Kane, P., & Garber, J. (2004). The relations among depression in fathers, children's psychopathology, and father–child conflict: A meta-analysis. *Clinical Psychology Review, 24*(3), 339–360. https://doi.org/10.1016/j.cpr.2004.03.004

Karnaze, M. M., & Levine, L. J. (2018). Sadness, the architect of cognitive change. In H. C. Lench (Ed.), *The function of emotion* (pp. 45–58). New York, NY: Springer.

Katz, L. F., Maliken, A. C., & Stettler, N. M. (2012). Parental meta-emotion philosophy: A review of research and theoretical framework. *Child Development Perspectives, 6*(4), 417–422. https://doi.org/10.1111/j.1750-8606.2012.00244.x

Katz, L. F., Stettler, N., & Gurtovenko, K. (2016). Traumatic stress symptoms in children exposed to intimate partner violence. *Social Development, 25*(1), 47–65. https://doi.org/10.1111/sode.12151

Klimes-Dougan, B., Brand, A. E., Zahn-Waxler, C., Usher, B., Hastings, P. D., Kendziora, K., & Garside, R. B. (2007). Parental emotion socialization in adolescence: Differences in sex, age and problem status. *Social Development, 16*(2), 326–342. https://doi.org/10.1111/j.1467-9507.2007.00387.x

Klimes-Dougan, B., Pearson, T. E., Jappe, L., Mathieson, L., Simard, M. R., Hastings, P., & Zahn-Waxler, C. (2014). Adolescent emotion socialization: A longitudinal study of friends' responses to negative emotions. *Social Development, 23*(2), 395–412. https://doi.org/10.1111/sode.12045

Kuebli, J., & Fivush, R. (1992). Gender differences in parent-child conversations about past emotions. *Sex Roles, 27*(11–12), 683–698. https://doi.org/10.1007/BF02651097

Lazarus, R. (1991). Progress on a cognitive-motivational-relational theory of emotion. *American Psychologist, 46*(8), 819–834.

Leaberry, K. D., Rosen, P. J., Fogleman, N. D., Walerius, D. M., & Slaughter, K. E. (2018). Physiological emotion regulation in children with ADHD with and without comorbid internalizing disorder: A preliminary study. *Journal of Psychopathology and Behavioral Assessment*, Advance online publication. https://doi.org/10.1007/s10862-018-9644-z

Leerkes, E. M., Supple, A. J., Su, J., & Cavanaugh, A. (2015). Links between remembered childhood emotion socialization and adult adjustment: Similarities and differences between European American and African American women. *Journal of Family Issues, 36*(13), 1854–1877.

Legerski, J. P., Biggs, B. K., Greenhoot, A. F., & Sampilo, M. L. (2015). Emotion talk and friend responses among early adolescent same-sex friend dyads. *Social Development, 24*(1), 20–38. https://doi.org/10.1111/sode.12079

Lindsey, E. W. (2016). Same-gender peer interaction and preschoolers' gender-typed emotional expressiveness. *Sex Roles, 75*(5–6), 231–242. https://doi.org/10.1007/s11199-016-0601-6

Lougheed, J. P., & Hollenstein, T. (2012). A limited repertoire of emotion regulation strategies is associated with internalizing problems in adolescence. *Social Development, 21*(4), 704–721. https://doi.org/10.1111/j.1467-9507.2012.00663.x

Luebbe, A. M., Kiel, E. J., & Buss, K. A. (2011). Toddlers' context-varying emotions, maternal responses to emotions, and internalizing behaviors. *Emotion, 11*(3), 697–703. https://doi.org/10.1037/a0022994

Lunkenheimer, E. S., Shields, A. M., & Cortina, K. S. (2007). Parental emotion coaching and dismissing in family interaction. *Social Development, 16*(2), 232–248. https://doi.org/10.1111/j.1467-9507.2007.00382.x

Malatesta, C. Z., Grigoryev, P., Lamb, C., Albin, M., & Culver, C. (1986). Emotion socialization and expressive development in preterm and full-term infants. *Child Development, 57*(2), 316–330. https://doi.org/10.2307/1130587

Malatesta, C. Z., & Haviland, J. M. (1982). Learning display rules: The socialization of emotion expression in infancy. *Child Development, 53*(4), 991–1003. https://doi.org/10.2307/1129139

Martin, N. G., Witherington, D. C., & Edwards, A. (2008). The development of affect specificity in infants' use of emotion cues. *Infancy, 13*(5), 456–468.

McElwain, N. L., Halberstadt, A. G., & Volling, B. L. (2007). Mother- and father-reported reactions to children's negative emotions: Relations to young children's emotional understanding and friendship quality. *Child Development, 78*(5), 1407–1425. https://doi.org/10.1111/j.1467-8624.2007.01074.x

McGuire, W., & Hull, R. F. C. (1977). *C.G. Jung speaking: Interviews and encounters*. Princeton, NJ: Princeton University Press.

Mesquita, B., & Frijda, N. H. (1992). Cultural variations in emotion: A review. *Psychological Bulletin, 112*(2), 179–204. https://doi.org/10.1037/00332909.111.2.179

Miller-Slough, R. L., & Dunsmore, J. C. (2016). Parent and friend emotion socialization in adolescence: Associations with psychological adjustment. *Adolescent Research Review, 1*(4), 287–305. https://doi.org/10.1007/s40894-016-0026-z

Miller-Slough, R. L., Dunsmore, J. C., Zeman, J. L., Sanders, W. M., & Poon, J. A. (2018). Maternal and paternal reactions to child sadness predict children's psychosocial outcomes: A family-centered approach. *Social Development, 27*, 495–509. https://doi.org/10.1111/sode.12244

Mirabile, S. P. (2015). Ignoring children's emotions: A novel ignoring subscale for the coping with children's negative emotions scale. *European Journal of Developmental Psychology, 12*(4), 459–471. https://doi.org/10.1080/17405629.2015.1037735

Montague, D. P. F., & Walker-Andrews, A. S. (2001). Peekaboo: A new look at infants' perception of emotion expressions. *Developmental Psychology, 37*(6), 826–838. https://doi.org/10.1037/0012-1649.37.6.826

Morelen, D., & Suveg, C. (2012). A real-time analysis of parent-child emotion discussions: The interaction is reciprocal. *Journal of Family Psychology, 26*(6), 998–1003. https://doi.org/10.1037/a0030148

Morelen, D., Zeman, J., Perry-Parrish, C., & Anderson, E. (2011). Children's emotion regulation across and within nations: A comparison of Ghanaian, Kenyan, and American youth. *British Journal of Developmental Psychology, 30*(3), 415–431. https://doi.org/10.1111/j.2044-835X.2011.02050.x

Morris, A. S., Silk, J. S., Steinberg, L., Myers, S. S., & Robinson, L. R. (2007). The role of the family context in the development of emotion regulation. *Social Development, 16*(2), 361–388. https://doi.org/10.1111/j.1467-9507.2007.00389.x

Murphy, B. C., & Eisenberg, N. (2002). An integrative examination of peer conflict: Children's reported goals, emotions, and behaviors. *Social Development, 11*(4), 534–557. https://doi.org/10.1111/1467-9507.00214

Nelson, J., Leerkes, E., Perry, N., O'Brien, M., Calkins, S., & Marcovitch, S. (2013). European-American and African-American mothers' emotion socialization practices relate differently to their children's academic and social-emotional competence. *Social Development, 22*(3), 485–498. https://doi.org/10.1111/j.146709507.2012.00673.x

O'Neal, C. R., & Magai, C. (2005). Do parents respond in different ways when children feel different emotions? The emotional context of parenting. *Development and Psychopathology, 17*(2), 467–487. https://doi.org/10.1017/S0954579405050224

Parke, R. D., Simpkins, S. D., McDowell, D. J., Kim, M., Killian, C., Dennis, J., … Simpkins-Chaput, S. (2002). Relative contributions of families and peers to children's social development. In C. Hart & P. K. Smith (Eds.), *Handbook of social development* (pp. 156–177). London, UK: Blackwell.

Parr, N. J., Zeman, J., Braunstein, K., & Price, N. (2016). Peer emotion socialization and somatic complaints in adolescents. *Journal of Adolescence, 50*, 22–30. https://doi.org/10.1016/j.adolescence.2016.04.004

Parra, G. R., Olsen, J. P., Buckholdt, K. E., Jobe-Shields, L., & Davis, G. L. (2010). A pilot study of the development of a measure assessing adolescent reactions to parents in the context of emotion socialization. *Journal of Child and Family Studies, 19*(5), 596–606. https://doi.org/10.1007/s10826-009-9343-1

Perry-Parrish, C., & Zeman, J. (2011). Relations among sadness regulation, peer acceptance, and social functioning in early adolescence: The role of gender. *Social Development, 20*(1), 135–153. https://doi.org/10.1111/j.1467-9507.2009.00568.x

Poon, J., Zeman, J., Miller-Slough, R., Sanders, W., & Crespo, L. (2017). "Good enough" parental responsiveness to Children's sadness: Links to psychosocial functioning. *Journal of Applied Developmental Psychology, 48*, 69–78. https://doi.org/10.1016/j.appdev.2016.11.005

Premo, J. E., & Kiel, E. J. (2014). The effect of toddler emotion regulation on maternal emotion socialization: Moderation by toddler gender. *Emotion, 14*(4), 782–793. https://doi.org/10.1037/a0036684

Raval, V. V., & Martini, T. S. (2009). Maternal socialization of children's anger, sadness, and physical pain in two communities in Gujarat, India. *International Journal of Behavioral Development, 33*(3), 215–219. https://doi.org/10.1177/0165025408098022

Raval, V. V., Martini, T. S., & Raval, P. H. (2007). "Would others think it is okay to express my feelings?" Regulation of anger, sadness, and physical pain in Gujarati children in India. *Social Development, 16*(1), 79–105. https://doi.org/10.1111/j.1467-9507.2007.00373.x

Raver, C. C., & Spagnola, M. (2002). When my mommy was angry, I was speechless: Children's perceptions of maternal emotional expressiveness within the context of economic hardship. *Marriage & Family Review, 34*(1–2), 63–88. https://doi.org/10.1300/J002v34n01_04

Reindl, M., Gniewosz, B., & Reinders, H. (2016). Socialization of emotion regulation strategies through friends. *Journal of Adolescence, 49*(1), 146–157. https://doi.org/10.1016/j.adolescence.2016.03.008

Root, A. E., & Rasmussen, K. E. (2017). Maternal emotion socialization: The contribution of inhibited behavior and mothers' dissatisfaction with the parent-child relationship. *Infant and Child Development, 26*(1), e1955. https://doi.org/10.1002/icd.1955

Rose, A. J., Schwartz-Mette, R. A., Smith, R. L., Asher, S. R., Swenson, L. P., Carlson, W., & Waller, E. M. (2012). How girls and boys expect disclosure about problems will make them feel: Implications for friendships. *Child Development, 83*(3), 844–863. https://doi.org/10.1111/j.1467-8624.2012.01734.x

Roseman, I. J. (1984). Cognitive determinants of emotions: A structural theory. In P. Shaver (Ed.), *Review of personality and social psychology* (Vol. 5, pp. 11–36). Beverly Hills, CA: Sage.

Roseman, I. J., Spindel, M. S., & Jose, P. E. (1990). Appraisals of emotion-eliciting events: Testing a theory of discrete emotions. *Journal of Personality and Social Psychology, 59*(5), 899–915.

Rutter, M., & Sroufe, L. A. (2000). Developmental psychopathology: Concepts and challenges. *Development and Psychopathology, 12*(3), 265–296.

Saarni, C. (1984). An observational study of children's attempts to monitor their expressive behavior. *Child Development, 55*(4), 1504–1513. https://doi.org/10.2307/1130020

Saarni, C. (1988). Children's understanding of the interpersonal consequences of dissemblance of nonverbal emotional-expressive behavior. *Journal of Nonverbal Behavior, 12*(4), 275–294. https://doi.org/10.1007/BF00987596

Saarni, C. (1999). *The development of emotional competence*. New York, NY: Guilford Press.

Sanders, W., Zeman, J., Poon, J., & Miller, R. (2015). Child regulation of negative emotions and depressive symptoms: The moderating role of parental emotion socialization. *Journal of Child and Family Studies, 24*(2), 402–415. https://doi.org/10.1007/s10826-013-9850-y

Scherer, K. R. (1982). Emotion as process: Function, origin, and regulation. *Social Science Information, 21*(3), 555–570.

Schwartz, O. S., Sheeber, L. B., Dudgeon, P., & Allen, N. B. (2012). Emotion socialization within the family environment and adolescent depression. *Clinical Psychology Review, 32*(6), 447–453. https://doi.org/10.1016/j.cpr.2012.05.002

Shipman, K., Zeman, J., Penza, S., & Champion, K. (2000). Emotion management skills in sexually maltreated and nonmaltreated girls: A developmental psychopathology perspective. *Development and Psychopathology, 12*(1), 47–62.

Shipman, K. L., Zeman, J., Nesin, A. E., & Fitzgerald, M. (2003). Children's strategies for displaying anger and sadness: What works with whom? *Merrill-Palmer Quarterly, 49*(1), 101–122. https://doi.org/10.1353/mpq.2003.0006

Silk, J. S., Steinberg, L., & Morris, A. S. (2003). Adolescents' emotion regulation in daily life: Links to depressive symptoms and problem behavior. *Child Development, 74*(6), 1869–1880. https://doi.org/10.1046/j.1467-8624.2003.00643.x

Skogstrøm Endrerud, M., & Vikan, A. (2007). Five to seven year old children's strategies for regulating anger, sadness, and fear. *Nordic Psychology, 59*(2), 127–134. https://doi.org/10.1027/1901-2276.59.2.127

Smith, C. A., & Ellsworth, P. C. (1987). Patterns of appraisal and emotion related to taking an exam. *Journal of Personality and Social Psychology, 52*, 475–488.

Sorber, A. V. (2001). *The role of peer socialization in the development of emotion display rules: Effects of age, gender, and emotion* (Unpublished doctoral dissertation). Brandeis University, Waltham, MA.

Sorber, A. V., & Cunningham, J. G. (1999). *Playmate preferences of preschoolers: The influence of emotion, gender, and family expressiveness*. Presentation at the biennial meeting of the Society for Research in Child Development, Albuquerque, NM.

Spinrad, T. L., Stifter, C. A., Donelan-McCall, N., & Turner, L. (2004). Mothers' regulation strategies in response to toddlers' affect: Links to later emotion self-regulation. *Social Development, 13*(1), 40–55. https://doi.org/10.1111/j.1467-9507.2004.00256.x

Sroufe, L. A. (1990). Considering normal and abnormal together: The essence of developmental psychopathology. *Development and Psychopathology, 2*(4), 335–347. https://doi.org/10.1017/S0954579400005769

Stein, N. L., & Jewett, J. L. (1986). A conceptual analysis of the meaning of negative emotions: Implications for a theory of development. In C. E. Izard & P. B. Read (Eds.), *Measuring emotions in infants and children* (Vol. 2, pp. 238–267). New York, NY: Cambridge University Press.

Stifter, C. A., & Braungart, J. M. (1995). The regulation of negative reactivity in infancy: Function and development. *Developmental Psychology, 31*(3), 448–455. https://doi.org/10.1037//0012-1649.31.3.448

Strayer, J., & Roberts, W. (2004). Children's anger, emotional expressiveness, and empathy: Relations with parents' empathy, emotional expressiveness, and parenting practices. *Social Development, 13*(2), 229–254. https://doi.org/10.1111/j.1467-9507.2004.000265.x

Sullivan, T. N., Helms, S. W., Kliewer, W., & Goodman, K. L. (2010). Associations between sadness and anger regulation coping, emotional expression, and physical and relational aggression among urban adolescents. *Social Development, 19*(1), 30–51. https://doi.org/10.1111/j.1467-9507.2008.00531.x

Suveg, C., Hoffman, B., Zeman, J., & Thomassin, K. (2009). Common and specific emotion-related predictors of anxious and depressive symptoms in youth. *Child Psychiatry and Human Development, 40*(2), 223–239. https://doi.org/10.1007/s10578-008-0121-x

Suveg, C., Payne, M., Thomassin, K., & Jacob, M. L. (2010). Electronic diaries: A feasible method of assessing emotional experiences in youth*? Journal of Psychopathology and Behavioral Assessment, 32*, 57–67. https://doi.org/10.1007/s10862-009-9162-0

Székely, E., Tiemeier, H., Jaddoe, V. W. V., Hofman, A., Verhulst, F. C., & Herba, C. M. (2014). Associations of internalizing and externalizing problems with facial expression recognition in preschoolers: The generation R study. *Social Development, 23*(3), 611–630. https://doi.org/10.1111/sode.12070

Thomassin, K., Morelen, D., & Suveg, C. (2012). Emotion reporting using electronic diaries reduces anxiety symptoms in girls with emotion dysregulation. *Journal of Contemporary Psychotherapy, 42*(4), 207–213. https://doi.org/10.1007/s108779-012-9205-9

Thompson, R. A. (1994). Emotion regulation: A theme in search of definition. *Monographs of the Society for Research Child Development, 59*(2–3), 25–52. https://doi.org/10.1111/j.1540-5834.1994.tb01276.x

Thompson, R. A., & Meyer, S. (2007). Socialization of emotion regulation in the family. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 249–268). New York, NY: Guilford Press.

Tillery, R., Cohen, R., Parra, G. R., Kitzmann, K. M., & Howard Sharp, K. M. (2015). Friendship and the socialization of sadness. *Merrill-Palmer Quarterly, 61*(4), 486–508. https://doi.org/10.13110/merrpalmquar1982.61.4.0486

Underwood, M. K. (1997). Peer social status and children's understanding of the expression and control of positive and negative emotions. *Merrill-Palmer Quarterly, 43*(4), 610–634.

Underwood, M. K., Coie, J. D., & Herbsman, C. R. (1992). Display rules for anger and aggression in school-age children. *Child Development, 63*(2), 366–380. https://doi.org/10.1111/j.1467-8624.1992.tb01633.x

Valiente, C., & Eisenberg, N. (2006). Parenting and children's adjustment: The role of children's emotion regulation. In D. K. Snyder, J. A. Simpson, & J. N. Hughes (Eds.), *Emotion regulation in couples and*

families: Pathways to dysfunction and health (pp. 123–142). Washington, DC: American Psychological Association.

Valiente, C., Eisenberg, N., Shepard, S. A., Fabes, R. A., Cumberland, A. J., Losoya, S. H., & Spinrad, T. L. (2004). The relations of mothers' negative expressivity to children's experience and expression of negative emotion. *Journal of Applied Developmental Psychology, 25*(2), 215–235. https://doi.org/10.1016/j.appdev.2004.02.006

Valiente, C., Fabes, R. A., Eisenberg, N., & Spinrad, T. L. (2004). The relations of parental expressivity and support to children's coping with daily stress. *Journal of Family Psychology, 18*(1), 97–106. https://doi.org/10.1037/0893-3200.18.1.97

Walker-Andrews, A. S., Krogh-Jespersen, S., Mayhew, E. M. Y., & Coffield, C. N. (2011). Young infants' generalization of emotional expressions: Effects of familiarity. *Emotion, 11*(4), 842–851. https://doi.org/10.1037/a0024435

Waters, S. F., & Thompson, R. A. (2014). Children's perceptions of the effectiveness of strategies for regulating anger and sadness. *International Journal of Behavioral Development, 38*(2), 174–181. https://doi.org/10.1177/0165025413515410

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Psychology, 54*(6), 1063–1070. https://doi.org/10.1037/0022-3514.54.6.10631070

Watson, D., & Tellegen, A. (1985). Toward a consensual structure of mood. *Psychological Bulletin, 98*(1), 219–235.

Whalen, C., Henker, B., Ishikawa, S., Jamner, L., Floro, J., Johnson, J., & Swindle, R. (2006). An electronic diary study of contextual triggers and ADHD: Get ready, get set, get mad. *Journal of the American Academy of Child and Adolescent Psychiatry, 45*(2), 166–174. https://doi.org/10.1097/01.chi.0000189057.679

Widen, S. C., & Russell, J. A. (2008). Young children's understanding of others' emotions. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (pp. 348–363). New York, NY: Guilford Press.

Zeman, J., Cassano, M., & Adrian, M. C. (2013). Socialization influences on children's and adolescents' emotional self-regulation processes. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 79–107). New York, NY: Routledge. https://doi.org/10.4324/9780203080719.ch5

Zeman, J., Cassano, M., Perry-Parrish, C., & Stegall, S. (2006). Emotion regulation in children and adolescents. *Journal of Developmental & Behavioral Pediatrics, 27*(2), 155–168.

Zeman, J., Dallaire, D., & Borowski, S. (2016). Socialization in the context of risk and psychopathology: Maternal emotion socialization in children of incarcerated mothers. *Social Development, 25*(1), 66–81. https://doi.org/10.1111/sode.12117

Zeman, J., Dallaire, D., Folk, J., & Thrash, T. (2018). Maternal incarceration, children's psychological adjustment, and the mediating role of emotion regulation. *Journal of Abnormal Child Psychology, 46*(1), 223–236.

Zeman, J., & Garber, J. (1996). Display rules for anger, sadness, and pain: It depends on who is watching. *Child Development, 67*(3), 957–973. https://doi.org/10.1111/j.1467-8624.1996.tb01776.x

Zeman, J., Klimes-Dougan, B., Cassano, M., & Adrian, M. (2007). Measurement issues in emotion research with children and adolescents. *Clinical Psychology: Science and Practice, 14*(4), 377–401. https://doi.org/10.1111/j.1468-2850.2007.00098.x

Zeman, J., Penza, S., Shipman, K., & Young, G. (1997). Preschoolers as functionalists: The impact of social context on emotion regulation. *Child Study Journal, 27*(1), 41–67.

Zeman, J., & Shipman, K. (1996). Children's expression of negative affect: Reasons and methods. *Developmental Psychology, 32*(5), 842–849. https://doi.org/10.1037/0012-1649.32.5.842

Zeman, J., & Shipman, K. (1997). Social-contextual influences on expectancies for managing anger and sadness: The transition from middle childhood to adolescence. *Developmental Psychology, 33*(6), 917–924. https://doi.org/10.1037/0012-1649.33.6.917

Zeman, J., & Shipman, K. (1998). The influence of social context on children's affect regulation: A functionalist perspective. *Journal of Nonverbal Behavior, 22*(3), 141–166.

Zeman, J., Shipman, K., & Suveg, C. (2002). Anger and sadness regulation: Predictions to internalizing and externalizing symptoms in children. *Journal of Clinical Child & Adolescent Psychology, 31*(3), 393–398.

Zimmerman, P., & Iwanski, A. (2014). Emotion regulation from early adolescence to emerging adulthood and middle adulthood: Age differences, gender differences, and emotion-specific developmental variations. *International Journal of Behavioral Development, 38*(2), 182–194. https://doi.org/10.1177/0165025413515405

Fear in Development

Vanessa LoBue, Emily Kim, and Mauricio Delgado

Abstract

In this chapter, we will provide an overview of the development of fear across infancy and early childhood. First, we describe various theoretical accounts of emotion and their implications for studying fear across development. Next, we describe the perception of threat, including how infants and young children first come to recognize and differentiate a fearful face from other emotional expressions and when they begin to detect signals of threat in the environment. We then describe the developmental trajectory of fearful behavior starting with infancy. We discuss the most commonly experienced fears from infancy to adulthood and how these fears might be acquired. Finally, we describe the neurological underpinnings of fear learning throughout development and close with a few thoughts on future directions for studying fear over the life span.

Fear is an emotion we have all experienced. Whether you are reluctant to get on a roller coaster, feel nervous in a crowded elevator, or the sight of a spider makes your skin crawl, we all know what it feels like to be afraid. Given the commonality of this experience, you might assume that defining fear and studying it in humans would be easy. Indeed, when do psychologists get the opportunity to study a phenomenon that is common across every single member of a species? Surprisingly, however, studying fear in the laboratory is quite difficult. Researchers agree that fear is an affective response to imminent threat (Delgado, Olsson, & Phelps, 2006; Ferrari, 1986), but they do not agree on the specifics of what constitutes a fearful response, or whether fear is appropriately described when using paradigms that likely measure a simpler threat response (see LeDoux, 2012). Despite widespread acceptance that a variety of behavioral and physiological responses are reasonable indices of fear (e.g., "fearful" facial expressions, accelerated heart rate, increased skin conductance responses), we still have no gold standard, no clear, objective, definitive set of criteria for identifying fear. Instead, many behaviors can reflect a single emotion and the same behavior can be in the service of multiple emotions (Campos, Frankel, & Camras, 2004). As a result, several researchers use self-report as the one reliable way to ensure that individuals are indeed afraid. However, this fail-safe method for

Vanessa LoBue was supported by the National Institute of Mental Health grant R01MH109692, and funding from the James McDonnell Foundation, and Mauricio Delgado was supported by the McKnight Foundation in the writing of this chapter.

V. LoBue (✉) · E. Kim · M. Delgado
Rutgers University—Newark, Department of Psychology, Newark, NJ, USA
e-mail: vlobue@psychology.rutgers.edu

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_11

identifying fear poses a problem if your participants have difficulty using language to describe their emotions (like toddlers), or if they cannot use language at all (like infants). So how then do we study fear over the course of development, especially in the first few years of life?

The ongoing debate about defining fear and its requisite behaviors has resulted in various theoretical frameworks for the study of emotion, each with different implications for identifying fear across development. The classic and most popular theory in social psychology is discrete emotions theory (DET), which postulates that a fixed set of "basic" emotions—including fear—are discrete, natural kinds. These basic emotions are innate, evolutionary adaptations to specific environmental challenges, and each has a distinct physiology and dedicated brain circuitry (e.g., Ekman & Cordaro, 2011; Izard, 2007; Panksepp, 2007). The state of a basic emotion like fear would produce a narrow set of stereotyped responses that are highly intercorrelated and unique from other emotions. In infants and young children, this set of responses includes fearful facial expressions (e.g., raised eyebrows and eyelids, mouth gaping open), crying or negative vocalizations, physiological changes such as accelerated heart rate, and behavioral avoidance (Izard, 2007). For some researchers, the requisite set of responses is also accompanied by the subjective feeling of fear (e.g., Ekman & Friesen, 1971), which would allow researchers to infer emotional experiences based on facial expressions and other behavioral indices (for review, see Lewis, 2013). Based on the similarity of fearful facial expressions in adults from different cultures, evidence of a spontaneous "fear face" in infants as young as 2 months of age, and stereotyped fear responses in animals when specific brain regions are stimulated, some researchers claim that fear is one of our basic and universal emotions, emerging early in development (Ekman, 1993; Ekman & Friesen, 1971; Izard, 1990, 1994; Izard, Heubner, Risser, McGinnes, & Dougherty, 1980; Panksepp, 2008; Reissland, Francis, Mason, & Lincoln, 2011).

In contrast to the discrete emotions approach, *emergent* theories—which we use as an umbrella term for constructivist, dimensional, and appraisal views—characterize fear as a process instead of a state (Coan, 2010; Lewis & Douglas, 1998). In the early stages of the process, subcortical brain regions (e.g., amygdala) are activated and accompanied by autonomic arousal which prepares the body for action. In subsequent stages, physiological changes in the body (accelerated heart rate, sweating, etc.) and additional information about the stimulus and its context are represented in the prefrontal cortex, allowing for comparison of previous events with the present situation (Cunningham & Zelazo, 2007, 2009). Fear emerges as a discrete emotion late in the process when early information is combined with interpretations of the environment and predictions about the future (Barrett, 2006; Clore & Ortony, 2000; Coan, 2010; Cunningham, Dunfield, & Stillman, 2013; Lewis & Douglas, 1998). At this point, individuals might display fearful facial expressions and vocalizations, show behavioral avoidance, and experience the subjective feeling of fear.

These two opposing theories differ in the predictions they would make about what fear might look like over the course of development. According to discrete accounts, activation of fear should elicit a number of stereotypical responses that are common across individuals and highly correlated. In contrast, according to emergent theories, the process of emotional expression is sufficiently flexible to stop short of fear. A sudden change in the environment, for example, might elicit elevated physiological responses, but the process would terminate if later appraisals dismiss the potential threat (Clore & Ortony, 2000; Coan, 2010). Thus, no single measure—except the subjective feeling of fear—necessarily implicates fear. Indeed, neural responses in the amygdala and accelerated heart rate, for example, can be elicited by changes in arousal and are associated with other feelings, including anger and happiness, and contextual situations (Coan, 2010; Kagan, 1988). Moreover, people show a wide range of individual differences in expressions of fear, and research suggests that various fear measures are not strongly intercorrelated (Barrett, 2006; Coan, 2010). Thus, researchers

adopting an emergent view require several converging measures to infer fear, absent the participant's report of feeling afraid (Barrett, 2006; Buss, 2011).

The two views also differ regarding the expected age at which infants might display fear. Again, the discrete emotions theory expects evidence of fear in very young infants because the suite of fearful responses could require only the activation of the requisite neural circuits, which are functional early in life since they are relatively automatic and evolutionarily conserved. In contrast, the emergent account expects a more protracted developmental trajectory because the subjective feeling of fear requires evaluation of contextual information, specifically an evaluation of imminent threat. In this account, discrete emotions such as fear are not present early in development. Instead, expressions of distress in young infants reflect only general negative affect. As infants acquire the ability to represent more contextual information, negative emotions would become increasingly differentiated and discrete (Camras, 2011; Lazarus, 1991; Lewis & Douglas, 1998; Sroufe, 1997).

Although the debate between DET and emergent theories dominates the areas of social psychology and affective neuroscience, the developmental literature has two additional approaches—the functionalist and dynamic systems perspectives—that often guide the design of developmental research. Functionalists conceptualize emotions by the potential adaptive functions that they serve. According to this perspective, no single outcome measure (e.g., like facial expressions for DET) is necessarily privileged in determining whether a behavior is emotional, and, instead, the presence or absence of an emotion is determined by whether an event has significance to the individual. In contrast, a dynamic systems approach does not make assumptions about, or privilege, the function of a particular emotion and, instead, focuses on the process by which emotions emerge across development based on context and individual difference factors (for a review of both accounts, see Witherington & Crichton, 2007). In both approaches, emotions can be viewed as a complex multicomponent system in which context is crucial, suggesting a potential fit with emergent perspectives. However, like DET, many functionalists view emotion as a system that evolved to cope with recurrent environmental challenges, and thus the functionalist approach could also be used alongside a broader discrete emotions perspective (e.g., Keltner & Gross, 1999).

In the following review, we take an emergent perspective, demonstrating that over the course of development, infants first recognize and express general negative affect, and the expression of fear and other discrete negative emotions develops slowly with concurrent changes in cognition and experience. We review the developmental trajectory of normative fears, defining a normative fear as a response to imminent threat that should increase as the proximity of the threat increases. These normative fears are different from clinical fears or phobias which are unreasonable or excessive responses that interfere with daily life and are not necessarily proportional to the proximity of the threat (Broeren, Lester, Muris, & Field, 2011; Lang, Davis, & Öhman, 2000). Consistent with this definition and fitting most closely with a process-based approach to emotion, we discuss the role of both situational context and individual differences in the expression and acquisition of fear throughout life and emphasize how a continuous developmental approach that makes use of multiple measures across varying contexts might be the most useful way of helping researchers understand the development of fear across the life span.

Perception of Fear

Given that we define fear as a response to imminent threat, an individual must detect the presence of a potentially threatening stimulus (usually indexed by attention to angry faces) and recognize the stimulus' threatening or emotional valence (usually indexed by attention to fearful faces) in order to experience and express fear. In the following section, we first describe how infants and young children come to recognize emotionally valenced stimuli—and fearful

expressions in particular—in the first few years of life. We then review the literature on the detection of threatening stimuli, including both social and non-social threats, and its implications for the development of fear and anxiety over the life span.

Perception and Recognition of Fear

Emotion perception begins very early in life. In fact, there is evidence that infants can differentiate between several emotional expressions, including happy, sad, and surprised faces, only hours after birth (Field, Woodson, Greenberg, & Cohen, 1983), and that they can discriminate between other discrete emotional expressions shortly thereafter (Barrera & Maurer, 1981; Farroni, Menon, Rigato, & Johnson, 2007; Young-Browne, Rosenfeld, & Horowitz, 1977). By the age of 4–5 months, infants differentiate between specific negatively valenced emotions, such as fear, sadness (Serrano, Iglesias, & Loeches, 1992), and anger (Schwartz, Izard, & Ansul, 1985), and further, their ability to categorize emotional expressions becomes even more refined in the second half of the first year. By 6–7 months of age, infants can categorize a number of variable expressions as the same emotion (Nelson, Morse, & Leavitt, 1979) and even detect category boundaries between faces when they are slowly morphed from one emotion to another (Kotsoni, de Haan, & Johnson, 2001).

Although infants show evidence that they can categorize various emotional expressions early in infancy, it is likely that this discrimination is based on categorical differences between the features of each facial expression and that infants are unable to interpret the emotional meaning associated with a fearful or threatening face before 5–7 months of age. For example, while very young infants differentiate between fearful and other facial expressions in the first few months of life, infants do not appear to *respond* differentially to fearful faces before 7 months of age (e.g., Peltola, Leppänen, Mäki, & Hietanen, 2009). Around 7 months, there is evidence that infants can both discriminate between various negative emotional expressions and that they might be beginning to understand the meaning of these faces by showing a distinct *bias* for fear, allocating more attention to fearful than to happy or neutral expressions based on both looking time measures and event-related potential (ERP) responses (e.g., Leppänen, Moulson, Vogel-Farley, & Nelson, 2007; Nelson & De Haan, 1996; Peltola, Leppänen, Mäki, & Hietanen, 2009).

While studies in adults suggest that such a bias for fearful faces is related to the processing of threat-relevant stimuli specifically, it is unclear whether this is the case for infants (Peltola, Leppänen, Mäki, & Hietanen, 2009). One hypothesis is that differential responding to fearful faces in infancy reflects a simple novelty preference. Indeed, although infants see a large number of happy, smiling expressions early in life, parents generally refrain from expressing negative emotions to their newborns (Malatesta & Haviland, 1982), and they do not regularly express fearful expressions until their infants become capable of independent locomotion (Campos et al., 2000; Serrano et al., 1992). Further, infants with highly positive mothers show a larger bias for looking at fearful over happy faces when compared to mothers who generally exhibit less positive affect (de Haan, Belsky, Reid, Volein, & Johnson, 2004), while the opposite is true for infants of depressed mothers or mothers who generally demonstrate more negative affect (Cohn, Matias, Tronick, Connell, & Lyons-Ruth, 1986; Field, 1992), providing support for the novelty preference hypothesis.

Conversely, others have argued that the emergence of a fear bias in face perception is evidence that infants are capable of recognizing threat for the very first time. Indeed, although infants show heightened responding to fear faces by 7 months of age, they show no such preference for angry faces (Krol, Monakhov, San Lai, Ebstein, & Grossmann, 2015) or for other novel facial expressions (Peltola, Leppänen, Palokangas, & Hietanen, 2008). Further, besides longer looking and heightened ERP responses to fearful faces, 7-month-olds (like adults) also take longer to *disengage* from a fearful face compared to a happy

face (Leppänen et al., 2010; Peltola et al., 2008; Peltola, Leppänen, Vogel-Farley, Hietanen, & Nelson, 2009). That is, when infants are presented with an image of an emotional facial expression in the center of a screen, they have difficulty disengaging from the face if it is fearful (when compared to happy or neutral) in order to look at a probe that appears simultaneously to the right or left side of the center image. Importantly, this effect remains even when researchers control for the salience of the fearful faces' eyes, suggesting that this response cannot be explained by simple perceptual differences between the emotion categories (Peltola, Leppänen, Vogel-Farley, et al., 2009).

Although it is still unclear whether infants understand the meaning of a fearful face by 7 months of age, there is clear evidence that by 12 months, infants can interpret a fear face as a sign of threat and use this social information to guide their behavior in novel situations. For example, 12-month-olds spend less time playing with a novel toy when it is previously paired with a fearful face or voice than when paired with a happy or neutral face/voice (Mumme & Fernald, 2003; Mumme, Fernald, & Herrera, 1996). Infants of the same age also play less with a novel toy when mothers tense their grip on the infants' abdomens after the toy is presented (Hertenstein & Campos, 2001) and move closer to their mothers when they see an experimenter pose a fearful face toward a novel object (Klinnert, 1984).

Some researchers have argued that these behaviors are evidence for a general negativity bias, and not necessarily a bias for fear in particular, citing the adaptive value of avoiding *any* stimulus that others find unpleasant (e.g., Vaish, Grossmann, & Woodward, 2008). However, although infants do show heightened attention to all negative facial expressions, avoidance behavior is most often reported for fearful faces, even when compared to other negative emotional expressions. For example, in a classic study by Sorce, Emde, Campos, and Klinnert (1985), 12-month-old crawling infants were presented with a visual cliff—a glass covered surface with a shallow side and a deep side. The visual cliff was designed specifically to present infants with an ambiguous or novel situation: It gives the appearance of a dangerous drop-off, but, in reality, there is no real danger of falling. After being placed on the shallow side of the cliff, infants' mothers stood on the deep side posing one of three facial expressions—happy, sad, or fearful—and the infants were then encouraged to crawl across. The researchers reported that when mothers posed a happy face, most of the infants crossed to the deep side; when mothers posed a sad face, some of the infants crossed; and when the mothers posed a fearful face, almost *none* of the infants attempted to venture onto the deep side of the cliff. These findings suggest that while any negative facial expression can elicit avoidance behavior, a fear face elicits the most avoidance responses (Sorce et al., 1985).

It is important to note that infants' avoidance responses in the presence of a fearful face are only evident in novel situations or in response to novel stimuli; avoidance behavior is not generally evident in situations that are familiar, where infants already have experience with an object or situation. For example, although Sorce et al. (1985) found evidence that 12-month-olds avoid crossing an ambiguous visual cliff when their mothers pose a fearful face, Tamis-LeMonda et al. (2008) found that avoidance responses are only evident at ambiguous heights and not for incredibly deep or shallow drop-offs. Using a real adjustable cliff (with no safety glass), these researchers first determined what kinds of drop-offs were actually safe (e.g., 1 cm), risky (e.g., 9 cm), and impossible (e.g., 90 cm) for 18-month-old walking infants to descend. They then asked mothers to pose either happy or fearful expressions on the other side of these safe, risky, and impossible drop-offs. The researchers reported that infants only heeded their mothers' advice for risky or ambiguous (e.g., 9 cm) drop-offs: When the drop-offs were safe (e.g., 1 cm), infants descended despite their mothers' fearful faces, and, when the drop-offs were impossible (e.g., 90 cm), infants avoided descending even when their mothers encouraged them to come (Tamis-LeMonda et al., 2008). In a follow-up study, the researchers reported that the same pattern was true for 12-month-old experienced crawlers, but

not for 12-month-olds who were novice walkers; 12-month-old novice walkers used their mothers' advice less consistently and for only the largest (i.e., 90 cm) drop-offs (Karasik, Tamis-LeMonda, & Adolph, 2016).

After the infancy and toddlerhood period, researchers generally study the development of emotion recognition by examining children's ability to label photographs of adults posing for various emotional expressions or by asking them to match emotion labels with stories that have corresponding elicitors. This body of work suggests that while children can produce the labels for most basic emotion categories before the age of 3, their ability to apply these labels correctly to various emotional expressions and situations develops gradually over the preschool and middle childhood years (Widen, 2013). For example, between the ages of 2 and 5, children first develop the ability to accurately attribute happy, angry, and sad labels to photographs of emotional expressions, with accurate labeling of fear faces (along with surprise and disgust) developing later (Widen & Russell, 2003). Importantly, children's errors in these tasks are systematic, and children most often mistake facial categories for other categories of the same valence (e.g., incorrectly labeling a fearful face as sad or angry; Widen, 2013; Widen & Russell, 2008). This suggests that children first develop the ability to attribute broad valence-based labels to facial expressions before they can recognize and label discrete negative emotions like fear. In fact, based on a large sample of over 1000 2- to 8-year-old children, Widen (2013) reported that over 80% of children showed this developmental pattern, first demonstrating accurate labeling of broad valence-based categories and only later developing the ability to accurately use more specific discrete category labels for emotional expressions.

These studies and others typically use highly iconic emotional stimuli, demonstrating that by middle childhood, children's ability to identify and label photographs of basic emotional expressions reaches that of adults. However, a handful of more recent studies using facial expressions of more varied intensities has shown that while children between the ages of 7 and 10 are highly accurate at identifying high intensity emotional expressions, there is a much longer developmental trajectory for accuracy in recognizing lower intensity faces. Further, this trajectory differs for different categories of emotion (e.g., happy versus disgusted), suggesting that emotional face recognition may not reach maturity until adulthood (Gao & Maurer, 2010; Thomas, De Bellis, Graham, & LaBar, 2007). These changes likely reflect cognitive advancements in theory of mind and experiential developments in the ability to predict emotional outcomes from social interactions, but further research is needed to determine the exact mechanisms that guide developmental change in this domain (Widen, 2013).

Altogether, developmental research on the recognition of fear suggests that it begins early in life but develops continuously throughout childhood. Even newborns can differentiate between positive and negative emotional expressions, but categorical perception of discrete negative emotions like fear versus anger and sadness develops over the course of the first few months of life. Further, evidence that infants recognize and understand the meaning behind these emotions develops even later, in second half of the first year, possibly beginning when infants begin to attend more to fearful faces over other emotional facial expressions, and clearly emerging by 12 months of age when infants begin to use fearful faces to guide action in ambiguous or novel situations. The ability to label emotional expressions and match emotion words with corresponding elicitors shows a similar developmental pattern that begins in the preschool years and continues into later childhood and adolescence. This developmental progression suggests that emotion perception begins early in life with the categorical perception of faces and becomes more nuanced as children develop the cognitive ability and experience to determine the meaning behind a fearful or threat-relevant expressions.

Threat Detection

In addition to the ability to perceive and differentiate fearful expressions in others, the ability

to detect signals of threat in the environment more generally is important for the experience and expression of fear, and for human survival. Humans have *attentional biases* for certain kinds of threatening stimuli—detecting them more quickly than other stimuli—starting in early childhood and even infancy. For example, when presented with a 3 × 3 matrix of images with a single target among 8 distracters, 3- to 5-year-old children and adults detect threatening targets like snakes and spiders more quickly than non-threatening targets like flowers, frogs, caterpillars, mushrooms, or cockroaches (LoBue, 2010a; LoBue & DeLoache, 2008). They also detect threatening faces—both angry and fearful—more quickly than happy, neutral, or even sad expressions (LoBue, 2009). In fact, when presented with side-by-side images of a snake and a flower, or an angry and happy face, even 9- to 12-month-old infants turn more quickly to look at snakes than flowers, and angry faces than happy faces (LoBue & DeLoache, 2010). Infants' physiological responses match their attention data: 6- to 9-month-olds show faster startle and lower heart rate in response to snake videos than to videos of other animals, indicative of heightened attention (Thrasher & LoBue, 2016).

One important question is whether attention biases for threat are related to fear. The traditional evolutionary model of threat detection proposes that humans have domain-specific mechanisms for the automatic detection of evolutionarily recurrent threats, like snakes and spiders and threatening conspecifics (e.g., angry faces); these mechanisms are proposed to be part of an "evolved fear module" that is automatically activated upon contact with threat, leading to fear and subsequent avoidance (Öhman & Mineka, 2001). According to this model, which is similar to the discrete emotions framework, a subset of threats should automatically activate the fear module, which would then cause a series of stereotypical fear responses to emerge. The results described above generally support this model, suggesting that rapid attention to threat is early developing, normative, and relatively stable across the life span.

Other studies demonstrate that some of these early developing attentional biases are not necessarily related to fear at all and can be elicited by the simple perceptual features of threatening stimuli. For example, presenting adults and children with low-level stimulus features common to snakes (i.e., their curvy shape) and angry faces (i.e., their "V"-shaped brow) are sufficient for eliciting rapid detection without any additional information (LoBue, 2014; LoBue & DeLoache, 2011; LoBue & Larson, 2010). Further, preschool-aged children detect coiled objects like hoses and wires more quickly than other stimuli, and when snakes are presented in an uncoiled position or when only the snake's face is shown, neither children nor adults detect them more rapidly than other stimuli (LoBue & DeLoache, 2011). This work suggests that rapid detection of some threats might be driven purely by their perceptual features and do not require participants to have knowledge about the stimuli, valenced information, or a specific emotional response.

However, additional work has demonstrated that threatening information or a fearful state can augment existing attention biases. For example, while all adults detect snakes and spiders more quickly than flowers and mushrooms, snake and spider phobic participants detect the object of their fear even more quickly than non-phobic controls (Öhman, Flykt, & Esteves, 2001). Further, labeling a curvy shape as a "snake" or inducing fear before asking participants to engage in a visual search task facilitates rapid detection of a curvilinear or snake-like shape, suggesting that cognitive and emotional factors might bolster existing attentional biases (LoBue, 2014).

There is also evidence that new attentional biases can be learned from negative experiences. Several studies using fear conditioning paradigms have shown that after pairing a neutral stimulus (i.e., a gray box, a neutral face, or a non-threatening animal) with an aversive shock, adults detect that stimulus more quickly than they detect other perceptually similar stimuli (Koster, Crombez, Van Damme, Verschuere, & De Houwer, 2004; Milders, Sahraie, Logan, & Donnellon, 2006; Purkis & Lipp, 2009). While adults detect a variety of modern threats like

knives and syringes more quickly than non-threatening stimuli like spoons and pens, 3-year-olds quickly detect syringes—a stimulus with which they all had negative experiences via painful vaccinations—but not knives—a stimulus with which they had little or no direct experience (LoBue, 2010b). This suggests that learning to associate a previously neutral stimulus with threat can lead to the development of a new attentional bias.

There is also evidence that early developing attentional biases interact with infant temperament to facilitate the development of fear and anxiety. Operationally, fear and anxiety are generally considered to be separate and distinct. Fear is an emotion, which is a valenced response to a specific event (Lazarus, 1994). Anxiety is generally considered to be a disposition (i.e., anxious mood) or a trait (i.e., temperamentally anxious) instead of a state (as in discrete emotions theory) or process (as in emergent theories). Further, anxiety does not necessarily have to be linked to a particular event. Anxiety can also be longer lasting than an emotion and can create conditions under which fear might be more likely to occur (Lazarus, 1994).

Importantly, as early as 2–4 years of age, children who are temperamentally shy, and are thus at risk for the development of social anxiety, show a heightened attention bias for social threats (i.e., angry faces) when compared to non-shy controls (LoBue & Pérez-Edgar, 2014; Pérez-Edgar et al., 2010, 2011). Further, while children who are behaviorally inhibited at ages 2 and 3 are socially withdrawn or shy, at age 5, this effect is moderated by an attentional bias to threat: The relationship between behavioral inhibition and social withdrawal was only significant in children who showed a heighted bias for angry versus happy faces (Pérez-Edgar et al., 2011). A second study reported a similar relationship in adolescents (Pérez-Edgar et al., 2010).

Although this work demonstrates a clear relation between attention biases for social threats and anxiety, it is still unclear whether biased attention to threat is a correlate, a risk factor, or simply a symptom of anxiety. Developmental research in this domain is still quite limited, but very recent work has shown that the relationship between attentional biases for threat and negative affect begins to develop within the first 6 months of life. Normative attentional biases for threatening stimuli—both non-social threats like snakes and social threats like angry faces—first emerge between the ages of 4 and 48 months of age (LoBue, Buss, Taber-Thomas, & Pérez-Edgar, 2017). However, for infants who are temperamentally high in negative affect, attending longer to angry faces is associated with slower subsequent fixations to other stimuli (Pérez-Edgar et al., 2017). In other words, for infants who show the highest levels of temperamental negative affect, the presence of threatening faces already impacts subsequent processing as early as 4 months of age (Pérez-Edgar et al., 2017). This is not the case for non-social threats. A bias for snakes appears by 4 months of age, is stable from 4 to 24 months, and is unrelated to negative affect (LoBue et al., 2017).

Altogether, this work demonstrates that attention biases for threat are early developing, normative, and stable across the life span, consistent with the traditional evolutionary model of threat detection. However, there is also evidence that some attention biases indeed change over time, new biases can be learned based on negative experience, and that individual differences can play a role in shaping attention biases over time. Further, recent work with infants suggests that attention biases for different kinds of threatening stimuli might have different developmental trajectories. For example, while attention biases for non-social threats like snakes appear to be normative, stable across the first 2 years of life, and unrelated to negative affect, attention biases for social threats might work in concert with individual differences in temperament to shape the developmental trajectory of social fear and anxiety. As a whole, this body of work suggests that attention biases for threat develop flexibly over the first few years of life, with different developmental trajectories for different kinds of threats that vary based on their perceptual features and individual differences in both temperament and experience.

Fearful Behavior

As mentioned above, fearful behaviors have traditionally been measured in a variety of ways based on a researcher's theoretical orientation. Many proponents of DET, for example, highlight the importance and universality of facial expressions of fear and might privilege a fearful face when measuring fearful behavior (e.g., Ekman & Cordaro, 2011). Other researchers, such as those who adopt a functionalist perspective, might privilege the function or goal of a behavior, and thus a fearful face or visible negative affect would not be necessary to conclude that an individual is afraid (e.g., Campos et al., 2004). Those who argue for an emergent or multicomponent perspective would not necessarily privilege any one single behavior in the expression of fear and, instead, view fear as a process that involves the interaction between multiple behaviors simultaneously (e.g., Coan, 2010).

Here, we take the latter, emergent, perspective to describe the development of fearful behavior, arguing that developmental data generally favor the notion that fear is a multicomponent system that requires converging measures to accurately identify. Indeed, no single behavior has been found to reliably and definitively indicate the presence of fear in any species (Marks, 1987), and previous research supports only a weak correlation between behavioral, physiological, and, in adults, self-report measures of emotion categories, including fear (Barrett, 2006; Lewis, Brooks, & Haviland, 1978). For example, Nesse et al. (1985) examined measures of distress during in vivo exposure therapy in phobic individuals. Although participants displayed increases in subjective anxiety, pulse, blood pressure, plasma norepinephrine, epinephrine, insulin, cortisol, and growth hormone, there was only modest convergence in the "magnitude, consistency, timing, and concordance" of their measures.

Classically, Lang (1968) proposed that emotions including fear consist of three main response systems, including subjective feelings and cognitions (verbal or cognitive responses), behavioral changes (avoidance and negative affect), and physiological changes. Thus, in the absence of verbal report, accurately identifying fear requires multiple measures (Buss, 2011), including both behavioral changes such as negative affect and avoidance, accompanied by physiological changes such as accelerated heart rate (Izard, 2007). In typical fear assessments designed for infants and young children, fear is often viewed as a profile of responses that includes measures of negative facial expressions (both the presence and intensity), bodily signs of fear (e.g., tense muscles, freezing, trembling), startle response, distress vocalizations (e.g., fussing, crying), and attempts to escape, as in the Lab-Tab—a standardized assessment of early temperament in infants, toddlers, and preschool-aged children (Goldsmith & Rothbart, 1999).

Emotional Expression in Infancy

As with the discrimination of discrete emotional expressions, infants also *express* discrete emotional facial expressions including fear, disgust, anger, sadness, happiness, and surprise as early as 1–2 months of age (e.g., Izard et al., 1980). However, these expressions are generally produced somewhat randomly, and not in response to an appropriate elicitor (e.g., Camras & Shutter, 2010), suggesting that although the facial musculature is in place to produce various emotional expressions at or shortly after birth, these early expressions do not necessarily correspond to any underlying emotional state. Infants do express negative affect (e.g., crying or fussing) within the first few months of life in response to various negative elicitors, such as being exposed to a bitter taste or having their arms restrained (Camras et al., 2007; Camras, Oster, Campos, Miyake, & Bradshaw, 1992; Camras & Shutter, 2010; Camras, Sullivan, & Michel, 1993; Ekman & Oster, 1979; Oster, Hegley, & Negel, 1992), but they do not produce discrete negative emotional expressions to appropriate elicitors until after several months of development.

Between 8 and 12 months of age—around the same time they begin to show evidence of understanding the meaning of a fearful face—infants begin to produce discrete fearful facial

expressions and other fearful behaviors in response to appropriate elicitors. Historically, developmental researchers have measured fear in infants using the visual cliff and the stranger approach paradigms, generally because it is widely believed that fears of strangers and heights are normative and appear in the first year of life (Slater & Quinn, 2012). However, more recent analyses suggest that while fear of strangers does develop in some infants by 12 months of age, fear of heights may not, and importantly, neither fear can be attributed to *all* typically developing infants at any age (e.g., Adolph, Kretch, & LoBue, 2014; LoBue & Adolph, 2019).

Using the visual cliff, classic research has shown that pre-locomotor infants do not demonstrate behavioral differences when presented with the shallow and deep sides of the cliff, but after several weeks of crawling experience, infants both avoid the deep side of the cliff and show heart rate acceleration when being lowered onto it (e.g. Campos, Bertenthal, & Kermoian, 1992). Many have interpreted these findings to suggest that self-produced locomotion leads to the development of fear of heights, which in turn produces avoidance behavior and heart rate acceleration on the visual cliff (Bertenthal, Campos, & Barrett, 1984; Campos et al., 1992, 2000; Campos, Hiatt, Ramsay, Henderson, & Svejda, 1978; Saarni, Campos, Camras, & Witherington, 2006).

Interestingly, none of the infants in these studies demonstrate evidence of negative affect of any kind. In fact, the predominant affective response to the visual cliff, even the deep side, is smiling (Saarni et al., 2006). Developmental researchers who adopt a functionalist perspective on emotional development have typically explained the absence of negative affect and, often, the presence of positive affect in these studies by arguing that the emotional system in infancy is not sufficiently coherent to produce negative affective displays in response to fear-eliciting situations (Campos et al., 2004). However, the lack of fearful or even negative emotional expressions is puzzling given that infants are capable of expressing general negative affect in response to an appropriate elicitor much earlier in development. This inconsistency has led others to question whether infants' behavior on the visual cliff really represents fear.

First, besides not producing any signs of negative affect, infants who show accelerated heart rate in response to being lowered onto the cliff often happily crawl across, suggesting that these converging measures of fear do not, in fact, converge (Ueno, Uchiyama, Campos, Dahl, & Anderson, 2011). Second, when infants are presented with a real cliff or other similar obstacle, such as a risky slope or gap in the floor, infants with weeks of locomotor experience do not avoid the drop-off at all; in fact, they spend most of their time right at the edge of the cliff exploring its properties and find alternative ways of descending when there is no safety glass if they deem crawling or walking to be impossible (e.g., Kretch & Adolph, 2013; see Adolph et al., 2014, for a review). Finally, avoidance in response to a real cliff does not transfer between locomotor postures: When placed in an experienced crawling posture, infants refuse to descend steep drop-offs or slopes but walk right over the edge when placed in an inexperienced walking posture (Adolph, 2000; Adolph, Tamis-LeMonda, Ishak, Karasik, & Lobo, 2008; Kretch & Adolph, 2013). This suggests that locomotor experience does not necessarily teach infants to be afraid of the drop-off per se; instead, it simply teaches infants when actions are possible and impossible for their bodies (Adolph et al., 2014; LoBue & Adolph, 2019).

Fear of strangers provides a much clearer example of a normative fear in infancy, as it produces a rich array of behavioral responses that varies between infants and contexts. Infants show that they can discriminate between strangers and their mothers shortly after birth (Field, Cohen, Garcia, & Greenberg, 1984) and look longer at strangers than at their mothers by 5 or 6 months of age (Bronson, 1972; Lewis et al., 1978; Lewis & Rosenblum, 1974; Sroufe, 1997). By 8–12 months of age, infants' emotional responses to strangers begin to vary based on context. Across most classic studies using the stranger approach paradigm—in which a novel person, often male, slowly walks toward an infant—infants show a rich and complex mix of behaviors ranging from very positive to very negative,

including smiling, affiliative responses such as toy sharing, a "sober" (i.e., a "serious" or neutral) facial expression, a shift from positive to neutral facial expression, gaze aversion, cessation of activity, and, in some less common cases, an increase in heart rate, frowning, moving away, and crying (see LoBue & Adolph, 2019, for a review). Although this range of behaviors might seem strange and inconsistent, they begin to cohere when researchers examine variations based on context.

For example, infants show the most negative responses to strangers—including heart rate acceleration, crying, and attempting to escape—when strangers approach quickly, when infants are seated away from their mothers, or when the stranger is a full-sized male adult. In contrast, they show few or no negative emotional responses—and in fact are more likely to show positive or affiliative behaviors—when the study is conducted in the infant's home, when infants are seated on their mothers' laps, or when the stranger is a child (Bronson, 1972; Brooks & Lewis, 1976; Ricciuti, 1974; Smith, 1974; Sroufe, 1997). Infants also show variation in their responses to strangers based on individual differences in temperament, with the most anxious infants showing the most negative responses, and the least anxious infants showing the most positive responses (e.g., Brooker et al., 2013; Buss, 2011; Buss, Davidson, Kalin, & Goldsmith, 2004).

Thus, although both fear of heights and fear of strangers have often been characterized as universal, normative fears that appear developmentally in most (if not all) infants, by our definition, a normative fear is a response to imminent threat that should vary based on proximity of the threatening stimulus; normative fears should thus be highly dependent on both context and experience, and they should not appear in all infants all the time. In fact, based on the lack of potential negative experience with threatening stimuli in the first few years of life, one would expect that only a few fears should be evident at this early age. Indeed, despite long-held claims that fear of heights emerges as a result of locomotor experience, presumably from falling, most infants do not experience major falls, and such falls are not generally predictive of fear of heights (e.g., Poulton & Menzies, 2002). Further, evidence from infants' responses to a real drop-off suggests that infants do not avoid them at all; instead, they appear to enjoy exploring at the very edge of a drop-off, they find alternative ways to descend if the height does not afford crawling or walking, and they show no evidence of negative affect in response to real or visual cliffs (Adolph et al., 2014; LoBue & Adolph, 2019).

In contrast, although stranger fear is not a behavior that is evident in all infants all the time, the rich array of responses that can be observed in infants at the approach of a stranger demonstrate the dynamic and complicated nature of fearful behavior. Some presumably familiar and safe contexts—an infant's home or a mother's lap—elicit almost no fearful responses from infants at all, while other, "stranger" situations that are more likely to be deemed threatening elicit more negative affect when aggravated by the approach of a stranger. Furthermore, it is worth noting that infants who show the highest levels of anxiety as children often behave as if all novel stimuli are threatening, responding negatively to these stimuli regardless of situation or context (e.g., Buss et al., 2004). In other words, infants who fail to evaluate the approach of a stranger based on contextual factors—children who demonstrate *dysregulated fear*—are most at risk for the development of anxiety disorders (Buss, 2011). Thus, normative fears can be observed and measured in infancy, by 8–12 months of age, but researchers should expect a wide range of individual differences and variability based on context and experience, which can be used to help researchers understand differences in developmental outcomes.

Emotional Expression in Later Childhood and Adolescence

After the infancy and toddlerhood period, fear is usually measured in later childhood and adolescence via parent or child self-report, or via questionnaires, such as the Fear Survey

Schedule for Children-Revised (FSSC-R; Ollendick, 1983). According to studies using the FSSC-R and other similar measures, normative fears follow a consistent developmental trajectory throughout childhood and adolescence. As mentioned above, in infancy and toddlerhood, fear of novel objects and people are most common, as well as to maternal separation, followed by fear of animals in early childhood, fear of injury in middle childhood, and self-evaluative fears in adolescence (Muris & Field, 2011). Phobias follow a similar developmental trajectory with supernatural fears beginning in the preschool years, followed by animal fears and fears of other natural phenomenon (e.g., heights, the dark) as well as fears of blood and injury in middle childhood, and finally the development of social fears such as fear of rejection and evaluation emerging in later childhood and adolescence (Broeren, Lester, Muris & Field, 2011; Muris & Field, 2010).

Although some researchers have suggested that there is an evolutionary basis for this developmental pattern (e.g., Öhman, Dimberg, & Öst, 1985), there is empirical evidence that this pattern is consistent with concurrent developments in cognition. If fear is a response to imminent threat, fear should increase as children begin to understand the nature of threat and change with children's growing experience with threatening stimuli (Muris & Field, 2011). Indeed, the prevalence of scary dreams and fear of fantastical creatures increase between the ages of 4 and 9 alongside children's increasing engagement in magical thinking; by age 9, these fears begin to wane, as worry about performing well in school and fear of rejection become more prominent (Muris, Merckelbach, Gadet, & Moulaert, 2000). Further, in a study of over 800 children and adolescents (aged 8–18), researchers reported that an increase in social and evaluative fears could be completely accounted for by cognitive factors, supporting the idea that most fears wax and wane over the course of development as children acquire more advanced social and cognitive capabilities (Westenberg, Drewes, Goedhart, Siebelink, & Treffers, 2004).

Fear Acquisition

Given that the development of fearful behavior follows a clear developmental pattern, many researchers have asked whether there are common mechanisms by which these fears are acquired. Like the data on fearful behavior in children and adolescents, much of the published data on fear acquisition has generally made use of retrospective reports. Unfortunately, such reports, especially in children, are inevitably flawed by memory bias. Thus, in the following section, we will discuss evidence from subjective reports with the addition of experimental data whenever possible. Although experimental data is not as subject to memory bias as retrospective report, experimental data does come with some drawbacks as well, namely, that fear acquisition is difficult to study in the lab because of obvious ethical issues. This poses an important challenge to any experimental study of children's responses to a truly fear-inducing stimulus in the lab. To address this issue, researchers interested in studying fear acquisition experimentally use mild techniques and generally examine "fearful behaviors" that are consistent with Lang's (1968) model, measuring either self-reports of fear, negative affect (e.g., fearful facial expressions), avoidance behavior, physiological changes, or some combination.

Three General Learning Pathways

Before the 1970s, the traditional assumption about fear learning was that all fears were acquired via direct classical conditioning. This model was thought to apply to even the youngest participants after John Watson famously demonstrated that 9-month-old "Little Albert" could be conditioned to fear a white rat after repeatedly pairing its appearance with a loud aversive noise (Watson & Rayner, 1920). Indeed, research from the clinical literature on both adults and children suffering from symptoms of post-traumatic stress disorder (PTSD) after experiencing a trauma confirms that long-lasting fearful behaviors can be acquired

through classical conditioning (Dollinger, O'Donnell, & Staley, 1984; Meiser-Stedman, 2002; Meiser-Stedman, Smith, Glucksman, Yule, & Dalgleish, 2008; Trickey, Siddaway, Meiser-Stedman, Serpell, & Field, 2012; Yule, Udwin, & Murdoch, 1990). However, although classical conditioning is still at the center of most theories of fear acquisition, it does not account for how all—or even most—fears are learned. As a result, researchers now accept that fears can also be acquired through two additional *indirect* pathways, namely via observational learning or by the transmission of verbal information (e.g., Askew & Field, 2008; Field & Purkis, 2011; Mineka & Zinbarg, 2006; Rachman, 1977).

Albeit limited in number, there are experimental studies supporting fear learning in children through these indirect pathways (see Askew & Field, 2007, 2008, Field, 2006, Muris & Field, 2010 for reviews). For example, children between the ages 7 and 10 are slower to approach novel animals that were previously paired with a fearful versus happy facial expression and report a higher rate of fear beliefs about these animals when compared to baseline (Broeren, Lester, Muris & Field, 2011; Askew & Field, 2007). Likewise, 6- to 9-year-olds show increased heart rate and slower approach responses to novel animals after being presented with negative versus positive or neutral verbal information (Field & Lawson, 2003; Field & Schorah, 2007). Importantly, similar effects with observational learning have been reported in infants as young as 15–20 months of age (Dubi, Rapee, Emerton, & Schniering, 2008; Gerull & Rapee, 2002), and the effects of negative verbal information have been shown to last up to 6 months after initial exposure (Field, Lawson, & Banerjee, 2008; Muris, Bodden, Merckelbach, Ollendick, & King, 2003), altogether suggesting that indirect pathways are indeed viable mechanisms for the acquisition of long-term fear responses starting in infancy.

Evolutionary Models

The majority of research on fear acquisition across the life span supports the importance of the three general learning pathways discussed above. Indeed, approximately 94% of children or parents self-report at least one of these three pathways as the primary source of their fears (King, Eleonora, & Ollendick, 1998). However, there are still a number of fears for which participants cannot cite one of these learning pathways (King et al., 1998). Further, fears are not proportionally distributed, with our most common fears consisting of biological or natural threats, including fear of heights, fear of enclosed spaces, fear of blood or injury, and fear of animals like snakes and spiders (Coelho & Purkis, 2009; Marks & Nesse, 1994; Öhman & Mineka, 2001; Seligman, 1971). As a result, several evolutionary theorists have posited that there are domain-specific mechanisms in place that privilege the development of some fears over others (Boyer & Bergstrom, 2011).

For example, according to the *non-associative model* of fear acquisition, fears of some evolutionarily recurrent threats—including heights and water—are early developing or innate and do not require specific experience (Menzies & Clarke, 1995; Poulton & Menzies, 2002). Thus, the developmental question for these fears is not whether we learn them but, instead, whether we can *unlearn* them via habituation. Evidence to support this perspective comes from retrospective reports demonstrating that while a substantial number of individuals cannot recall specific instances of learning for fears of water, spiders, and heights, non-evolutionary fears, like fear of the dentist, can almost always be attributed to specific experiences (for a review, see Poulton & Menzies, 2002). Although these data cast doubt on the general learning model, they have been criticized for reliance on retrospective reports, which depend on adults' limited ability to recall instances of fear learning from their past (Coelho & Purkis, 2009; Poulton, Davies, Menzies,

Langley, & Silva, 1998). Indeed, one study with younger participants demonstrates that 9- to 14-year-old girls with a spider phobia have no problem describing the events that led to their fear learning of spiders (Merckelbach, Muris, & Schouten, 1996). Further, many of the studies supporting the non-associative view only focus on direct conditioning experiences and ignore the potential contribution of indirect pathways (Muris, Merckelbach, de Jong, & Ollendick, 2002).

In contrast to the non-associative model, proponents of the *prepared learning model* acknowledge that all fears are learned via conditioning. However, proponents of this model suggest that fear learning for evolutionarily recurrent threats is privileged and occurs more rapidly than for non-recurrent threats (Seligman, 1971). This rapid learning is governed by an "evolved fear module" (as discussed in the section on *Threat Detection*) or a set of dedicated brain circuitry that is activated automatically upon contact with a threatening stimulus (Öhman & Mineka, 2001). Evolutionary recurrent threats like snakes and spiders would thus be highly represented in clinical fears and phobias because humans would be likely to quickly learn a long-lasting, and perhaps overly strong, fear of these stimuli. Support for the prepared learning model comes from research demonstrating that lab-reared rhesus monkeys quickly develop a fear of snakes (but not flowers) after watching a similar fear response from a conspecific. Further, when adults are conditioned to associate an unpleasant electric shock with photographs of snakes and spiders versus flowers and mushrooms, extinction takes longer when conditioned with snakes and spiders (see Öhman & Mineka, 2001 for a review).

Despite widespread support for the prepared learning model (e.g., Rachman, 2002), it has also garnered some important criticisms. First, it is difficult to identify what kinds of stimuli qualify as "evolutionarily" threat-relevant, as it requires assumptions about what was dangerous in our evolutionary past (Coelho & Purkis, 2009; Kleinknecht, 2002; McNally, 2002). Further, while some stimuli that are deemed "evolutionary" threats are indeed dangerous to humans, others are not. For example, while venomous snakebites constitute a significant number of deaths worldwide each year (up to 94,000) (Kasturiratne et al., 2008), only a very small percentage of spiders are actually dangerous to humans (Forrester & Stanley, 2004; McNally, 2002).

Individual Differences and Combined Models

Although these different pathways for fear acquisition are often discussed and tested in isolation, it is unlikely that most fears are acquired from a single isolated experience with a threatening stimulus. Instead, combinations of experiences likely build over time, making most fears the product of an interaction between multiple learning pathways (Muris & Field, 2011). Further, there are other factors that might make some children and some stimuli more susceptible to fear learning than others (Askew, Kessock-Philip, & Field, 2008; Coelho & Purkis, 2009; Field & Purkis, 2011; Mineka & Zinbarg, 2006). First, research suggests that girls exhibit higher levels of fear than boys, African American children exhibit higher levels of fear than Caucasian children, and children from a lower socioeconomic status (SES) exhibit higher levels of fear than children from higher SES groups (e.g., Ollendick, Yang, Dong, Xia, & Lin, 1995). Although it is not clear why this is the case, researchers have suggested that it is likely due to differences in socialization practices (e.g., parents' greater acceptance of fearful behavior in girls than boys).

Second, developmental fears are sensitive to contextual factors such as parenting, which can either buffer or exacerbate fear-learning experiences. For example, while one study reported that 8- to 10-year-old children who watched news coverage with threatening information were more likely to demonstrate higher levels of fear and worry than other children, this effect was moderated by parenting: Children whose parents helped them understand the threatening content did not exhibit high levels of fear (Buijzen, Van der Molen, & Sondij, 2007). Similarly, another study

reported that a neglectful maternal parenting style was associated with an increase in children's fearful responses to negative verbal information (Price-Evans & Field, 2008). Although research in this domain is still quite limited, these findings suggest that if the environment is warm and supportive, children might be less receptive to fear learning, and likewise, if the environment is negative, children might be more prone to learning from threatening information.

Third, there is a large body of research suggesting that individual differences in the presence of fear and anxiety are associated with child temperament, or his/her own individual style of emotional responding to novel stimuli. Children who have a more inhibited or reactive temperament—and thus respond to novel stimuli with more negative affect—are more likely to acquire specific fears and anxiety problems when compared to children with less reactive temperaments (e.g., Buss, 2011; Buss et al., 2004; Field & Price-Evans, 2009; Field & Purkis, 2011; Reynolds, Askew, & Field, 2018), suggesting that fear learning is susceptible to individual differences in a child's own way of responding to the environment.

Finally, early developing attentional biases might also make fear acquisition for some stimuli more likely than others. As described above, countless studies have shown that human adults have attentional biases for threat, detecting various threatening stimuli—including snakes, spiders, and threatening faces—more rapidly than benign control displays, and that these attentional biases are associated with higher levels of specific fear and anxiety (e.g., Öhman, Flykt, & Esteves, 2001; Öhman, Lundqvist, & Esteves, 2001). One possibility is that stimuli that elicit physiological or attentional responses might be particularly easy to associate with fear. Such differential responses could draw attention to a stimulus or even prime subsequent appraisals, making learning easier in the presence of threatening information (Davey, 2002; LoBue, 2013, 2016; LoBue & Adolph, 2019; LoBue & Rakison, 2013; LoBue, Rakison, & DeLoache, 2010).

More recent models allow for individual differences in fear acquisition and acknowledge that different learning pathways might work in conjunction to shape the development of specific fears. Several of these models still consider direct conditioning to be central for fear learning but argue that verbal information and social information could create expectancies and possibly facilitate fear learning if conditioning were to take place, particularly when combined with individual difference factors like temperament (e.g., Davey, 1997; Mineka & Zinbarg, 2006). For example, hearing repeated negative information could create a store of past knowledge about the threatening properties of a stimulus, resulting in expectancies that make later conditioning easier (Field & Purkis, 2011). Likewise, negative verbal or social information might function to intensify fears that already exist (Muris & Field, 2010).

Other combined models allow for social and verbal information to be the primary pathway for fear acquisition but propose that the mechanism for learning is still associative in nature. For example, Field (2006) suggested that negative verbal information, for example, could elicit associative learning through children's mental representations. In other words, if a child hears about a snake biting another child, he could subsequently imagine the snake biting *him* and experience fear. In this example, threatening information is the primary source for fear acquisition, but the mechanism for learning is still associative if the child's mental representation of the snake is paired with his fearful response. The same can happen through children's experience with media: A child might watch a movie and experience fear while seeing a scary clown kidnap another child; later, the child might imagine the clown kidnapping him, producing a fear response. Again, the primary source for fear acquisition is the content of the movie, but the mechanism for learning is still associative (see Field & Purkis, 2011, for a detailed review of fear conditioning).

In summary, there are several theoretical models that describe various pathways for fear acquisition over the course of development. All of these models agree that fears can be learned through classical conditioning, and most endorse indirect pathways such as vicarious conditioning

and the transmission of verbal information as well. Despite the fact that all three of these domain-general learning mechanisms have been shown to produce fearful behaviors, several researchers have pointed out that fears are unevenly distributed, and some fears—such as fears of snakes, spiders, heights, and blood/injury—are indeed more common than others. As a result, more recent combined models of fear acquisition often view fear learning as part of a continuum, where some fears are learned more easily than others, and where some children are especially susceptible to fear learning based on individual differences and contextual factors (e.g., Davey, 1997; Field, 2006; Marks, 2002; Mineka & Zinbarg, 2006). Although evolutionary models suggest that domain-specific mechanisms are responsible for the fact that some fears are acquired quickly with little or no learning, combined models suggest that attentional or physiological changes could instead lead to facilitated learning or that prior experience (i.e., through negative verbal information) could result in expectancies that make conditioning easier (Field & Purkis, 2011). Future research is still needed to determine the exact nature of facilitated fear learning and how individual differences might interact with the various learning pathways to result in some of our most common fears.

Fear in the Brain: Developmental Implications

A key brain region involved in emotional responses is the amygdala—an almond-shaped structure located in the medial temporal lobe (Swanson & Petrovich, 1998). More specifically, the amygdala is involved in emotional processing irrespective of valence (Janak & Tye, 2015) with responses more pronounced based on the intensity of stimuli (Anderson, Christoff, Panitz, Rosa, & Gabrieli, 2003). The amygdala's role in emotion can have an impact on several cognitive processes and behavior (e.g., memory; Cahill & McGaugh, 1998) with consequences to long-term well-being (Roozendaal et al., 2009). Notably, neuroscience research across several species highlights the prominent involvement of the amygdala in the processing of threat-related information or fear (Phelps & LeDoux, 2005). The amygdala has been associated with basic processes, such as the perception and expression of fear, that are intertwined with more dynamic learning processes which foster fear acquisition. While most of the knowledge gained from neuroscience on fear processes has emerged from a rich animal literature and neuroimaging and neuropsychological studies of the adult human brain, more recent investigations in the developing brain support these findings and raise important questions for future consideration.

In the adult brain, the human amygdala is often activated in neuroimaging experiments focusing on the presentation of stimuli that signal potential threat in the environment, such as fearful faces (e.g., for review see Adolphs, 2008) or alarming sounds (e.g., screams; Lau et al., 2011). In support of such studies, patients afflicted with lesions in the amygdala show deficits in recognizing fearful faces, but less so with other emotional faces, presenting more causal data on the involvement of the amygdala in the perception of fear (Adolphs, 2008). Interestingly, studies have also suggested that failure to attend to specific features of the fearful face, such as the fearful eye expression, can account for some of the amygdala deficits and highlight how certain features of biologically relevant stimuli could signal threat (Adolphs et al., 2005).

Beyond responding to the presence of potential threat stimuli, the amygdala is also involved in learning about such threats. The classic experimental approach to study how fears are acquired is Pavlovian conditioning. Rodent models elegantly demonstrate that conditioned stimuli associated with the delivery of an aversive stimulus (e.g., shock or aversive tone) elicit conditioned responses such as freezing, increases in sympathetic responses and hormonal changes, and that such responses are mediated by the integrity of the amygdala (for review see Phelps & LeDoux, 2005). The human amygdala is also recruited during fear conditioning paradigms using functional magnetic resonance imaging (fMRI; LaBar, Gatenby, Gore, LeDoux, & Phelps, 1998).

Further, patients with lesions in the amygdala fail to show sympathetic responses to conditioned stimuli, measured via skin conductance responses, despite explicit recognition of the association (Anderson & Phelps, 2000).

The putative role of the amygdala in fear acquisition extends to indirect forms of learning previously discussed in this chapter, from instruction-based learning where participants are told what the contingency is (Phelps et al., 2001) to more social types of learning that may occur via observation (Olsson, Nearing, & Phelps, 2007). Indeed, the evidence across species and methodologies is that the amygdala is essential for learning about fears. Importantly, the perception and experience of fear can also generalize to other non-threatening stimuli based on the intensity of the stimulus (Dunsmoor, Mitroff, & LaBar, 2009), with physiological expression of fear (e.g., skin conductance responses) correlating with increased amygdala activation (Dunsmoor, Prince, Murthy, Kragel, & LaBar, 2011) and highlighting a pathway to the overgeneralization of fear common across anxiety disorders (Dymond, Dunsmoor, Vervliet, Roche, & Hermans, 2015).

Given the integral role of the amygdala in the acquisition and expression of fear, and the potential of this activity to generalize and foster chronic stress and anxiety-like symptoms, getting rid of fear representation is a priority research topic with translational implications for clinical applications beyond the scope of this chapter. Nevertheless, it is important to note that the critical relationship between the prefrontal cortex and amygdala allows for emotion regulation processes to develop during an individual's lifetime.

The prefrontal cortex projections to the amygdala can serve the role of inhibiting amygdala responses, and often an inverse relationship is observed between the two structures in studies of aversive processing and emotion regulation (Kim & Whalen, 2009; Urry et al., 2006). Specifically, greater connectivity between the prefrontal cortex and amygdala—where prefrontal cortex serves to inhibit amygdala activity—is observed in processes such as extinction learning (Phelps, Delgado, Nearing, & LeDoux, 2004), emotion regulation of conditioned threat (Delgado, Li, Schiller, & Phelps, 2008) or other aversive stimuli (Ochsner & Gross, 2005), and reversal learning (Schiller, Levy, Niv, LeDoux, & Phelps, 2008), underscoring the importance of the connectivity between prefrontal regions and amygdala in promoting change to emotional representations that can become maladaptive (Hartley & Phelps, 2010; Schiller & Delgado, 2010).

There are important structural and functional differences in the neurocircuitry involved in fear across development. Such differences are characterized by an overdependence on amygdala-related signals early in life, prior to the maturation of cortical connections that can better serve an emotion regulatory role. The amygdala is a structure that is postulated to be intact early in life based on rodent data (Bouwmeester, Smits, & Ree, 2002) with rapid rates of growth prior to adolescence (Gilmore et al., 2012). In contrast, prefrontal cortex development occurs on a slower trajectory (Casey, Jones, & Hare, 2008), with functional connectivity between the amygdala and medial prefrontal cortical sites maturing during adolescence (Gee, Humphreys, et al., 2013). The structural differences in the amygdala and prefrontal cortex translate to enhanced sensitivity to emotional stimuli during critical developmental stages. For instance, acquisition of threat-like information via aversive conditioning paradigms occurs at a high rate in children (Gao, Raine, Venables, Dawson, & Mednick, 2010). Indeed, enhanced sensitivity to aversive stimuli is more apparent in early childhood compared to older individuals (Silvers et al., 2017). Activity in the amygdala to aversive learning paradigms is also greater in adolescents compared to adults (Lau et al., 2011), although exaggerated amygdala reactivity to threat stimuli (e.g., fearful faces) decreases through adolescence into adulthood (Gee, Gabard-Durnam, et al., 2013).

One interesting hypothesis is that children may have stronger responses to an uncertain and unpredictable environment, which has the adaptive function to train the prefrontal cortex in appropriate threat representation and responses (Tottenham & Gabard-Durnam, 2017). This

could explain why some children, unlike adults, show increased amygdala reactivity to neutral faces (Thomas et al., 2001). Further, unpredictable situations (e.g., threat of an aversive outcome) can foster greater amygdala activity (Davis, Neta, Kim, Moran, & Whalen, 2016) and increased negative evaluation of ambiguous cues (Neta et al., 2017). Given that uncertainty or unpredictability is greater during early stages of childhood, this potentially explains greater amygdala reactivity to aversive stimuli early in childhood. It also highlights the vulnerability of this developmental period to early life stress, which can have maladaptive impacts in behavior later in life due to structural and functional changes in the amygdala as a result of such stress (Hanson et al., 2015).

Since cortical connections are not yet mature during early life and typical emotion regulation processes do not emerge prior to adolescence (Callaghan & Richardson, 2013), alternative mechanisms become imperative in regulating amygdala reactivity. One such mechanism is social buffering, which can occur at various stages of life, with parental care being most important early on, then shifting to peers during adolescence, and more romantic relationships in adulthood (Coan, Schaefer, & Davidson, 2006; Masten, Telzer, Fuligni, Lieberman, & Eisenberger, 2012). Deprivation of parental or caregiver care during infancy leads to an onset of problematic symptomology associated with behavioral disorders (e.g., anxiety, impulsivity; Ellis, Fisher, & Zaharie, 2004), underscoring the critical role of this social buffering mechanism early in life, when cortical regulatory mechanisms are not yet available, in helping to cope with the deleterious impact of stress (Hostinar, Sullivan, & Gunnar, 2014) in an uncertain environment (Tottenham, 2015).

Conclusions and Future Directions

In summary, the literature suggests that fear develops gradually with the perception and expression of negative affect, and slowly becomes a more specific response to imminent threat once infants gain the experience and cognitive capacity to differentiate between novel and familiar stimuli, and once they can determine when those stimuli might indeed pose a threat. Early in development, fear can be difficult to identify in preverbal infants, but research using the stranger approach and other similar paradigms suggests that the behaviors associated with fear are complex and highly dependent on context and individual differences. Likewise, the acquisition of fear can be explained by several domain-general mechanisms and is similarly affected by individual differences in emotionality, context, and differences in the properties of an individual stimulus.

There are several important issues to address for future research. First, since fear is difficult to study in the lab, there is still much to be learned about the development of specific fears over the life span. And although there is a large amount of data supporting various pathways for fear learning, it is still unclear whether these pathways are differentially effective in producing fear at various stages of development.

For example, despite some agreement among researchers that learning pathways should work together to produce fears developmentally, very few studies have investigated this possibility experimentally. One study, however, did manipulate negative verbal information before children received a direct conditioning experience to examine both the individual and combined strength of each learning pathway. Field and Storksen-Coulson (2007) presented 6- to 8-year-old children with threatening verbal information (or no verbal information) about a novel animal, and then exposed them to a direct conditioning event where children were instructed to touch an animal in a closed box that suddenly started to move. Although both negative verbal information (without the conditioning event) and direct conditioning (in the no verbal information condition) led to an increase in self-reported fear beliefs and avoidance behavior, negative verbal information followed by conditioning had the strongest effect on subsequent behavior. Askew et al. (2008) later replicated these findings with a vicarious learning procedure instead of conditioning, suggesting

that different pathways can indeed work together to produce fearful behaviors.

Another important consideration is whether the efficacy of each of these learning pathways can change over the course of development. For example, while direct conditioning might indeed be the most powerful pathway for fear conditioning across development, it is unlikely that our most common fears—such as fears of snakes and spiders—are acquired via direct negative experiences with these stimuli, leaving open the possibility that observational and instructed learning affect fear acquisition at different ages. Preverbal infants, for example, might learn best by observation, since verbal information or instruction carries little meaning without further language development. As mentioned above, it is common for infants in the second half of the first year to use their mothers' facial expressions as signals for how to behave in novel situations, so it is possible that this particular pathway might be most powerful for fear learning in preverbal infants.

However, after 12–18 months of age, babies less frequently look to their mothers' faces for information than they might have at younger ages (e.g., Kretch, Franchak, & Adolph, 2014). Further, they become more verbal, suggesting that negative verbal information might become an increasingly important pathway for fear learning from infancy to early childhood. Indeed, verbal information sharing is incredibly common between children, their parents, and their peers (Lang, 1968; Muris & Field, 2011). In fact, in a large study of over 1000 children between the ages of 9 and 14, researchers reported that the overwhelming majority of children with fears said that those fears were acquired by hearing or seeing scary things from other people (including parents, teachers, and friends) or from a media source (Ollendick & King, 1991). Media might then play a growing role in fear learning from early to middle childhood, and research has confirmed that children exposed to threat on television are more likely to develop fears than children with less exposure to threat on TV (see Muris & Field, 2011 for a review).

Further, while newer research is beginning to provide some insight into how individual differences in temperament and attention biases might work together to facilitate the development of fear and anxiety, this area of research is relatively new. Future work that implements longitudinal designs with infant samples would be useful in helping researchers propose a new model of how attention biases develop over time and how they might interact with temperamental and environmental factors to produce adaptive or maladaptive emotional responses (see Field & Lester, 2010; Morales, Fu, & Pérez-Edgar, 2016). Future work embracing an individual differences perspective on fear acquisition that acknowledges the vast amount of variability in emotional expression among individuals is a promising new direction. Again, given the ethical problems with experimental work on fear acquisition, long-term prospective studies on the development of childhood fear and anxiety that take advantage of multiple measures are greatly needed (Muris & Field, 2011). This kind of work—research that takes a developmental perspective and makes use of multiple data collection strategies, including behavioral, physiological, and neural—has the potential of tapping into the dynamic and multifaceted nature of emotional responding and can ultimately advance our understanding of how fear first develops and changes over the course of the life span.

References

Adolph, K. E. (2000). Specificity of learning: Why infants fall over a veritable cliff. *Psychological Science, 11*, 290–295.

Adolph, K. E., Kretch, K. S., & LoBue, V. (2014). Fear of heights in infants? *Current Directions in Psychological Science, 23*, 60–66.

Adolph, K. E., Tamis-LeMonda, C. S., Ishak, S., Karasik, L. B., & Lobo, S. A. (2008). Locomotor experience and use of social information are posture specific. *Developmental Psychology, 44*, 1705–1714.

Adolphs, R. (2008). Fear, faces, and the human amygdala. *Current Opinion in Neurobiology, 18*, 166–172.

Adolphs, R., Gosselin, F., Buchanan, T. W., Tranel, D., Schyns, P., & Damasio, A. R. (2005). A mechanism for impaired fear recognition after amygdala damage. *Nature, 433*(7021), 68.

Anderson, A. K., Christoff, K., Panitz, D., Rosa, E. D., & Gabrieli, J. D. E. (2003). Neural correlates of the

automatic processing of threat facial signals. *Journal of Neuroscience, 23*, 5627–5633.

Anderson, A. K., & Phelps, E. A. (2000). Expression without recognition: Contributions of the human amygdala to emotional communication. *Psychological Science, 11*, 106–111.

Askew, C., & Field, A. P. (2007). Vicarious learning and the development of fears in childhood. *Behaviour Research and Therapy, 45*, 2616–2627.

Askew, C., & Field, A. P. (2008). The vicarious learning pathway to fear 40 years on. *Clinical Psychology Review, 28*, 1249–1265.

Askew, C., Kessock-Philip, H., & Field, A. P. (2008). What happens when verbal threat information and vicarious learning combine? *Behavioural and Cognitive Psychotherapy, 36*, 491–505.

Barrera, M. E., & Maurer, D. (1981). Recognition of mother's photographed face by the three-month-old infant. *Child Development, 52*, 714–716.

Barrett, L. F. (2006). Solving the emotion paradox: Categorization and the experience of emotion. *Personality and Social Psychology Review, 10*, 20–46.

Bertenthal, B. I., Campos, J. J., & Barrett, K. C. (1984). Self-produced locomotion: An organizer of emotional, cognitive, and social development in infancy. In R. N. Emde & R. J. Harmon (Eds.), *Continuities and discontinuities in development* (pp. 175–210). New York, NY: Plenum Press.

Bouwmeester, H., Smits, K., & Ree, J. M. V. (2002). Neonatal development of projections to the basolateral amygdala from prefrontal and thalamic structures in rat. *Journal of Comparative Neurology, 450*, 241–255.

Boyer, P., & Bergstrom, B. (2011). Threat-detection in child development: An evolutionary perspective. *Neuroscience and Biobehavioral Reviews, 35*, 1034–1041.

Broeren, S., Lester, K. J., Muris, P., & Field, A. P. (2011). They are afraid of the animal, so therefore I am too: Influence of peer modeling on fear beliefs and approach–avoidance behaviors towards animals in typically developing children. *Behaviour Research and Therapy, 49*, 50–57.

Bronson, G. W. (1972). Infants' reactions to unfamiliar persons and novel objects. *Monographs of the Society for Research in Child Development, 37*, 1–46.

Brooker, R. J., Buss, K. A., Lemery-Chalfant, K., Aksan, N., Davidson, R. J., & Goldsmith, H. H. (2013). The development of stranger fear in infancy and toddlerhood: Normative development, individual differences, antecedents, and outcomes. *Developmental Science, 16*, 864–878.

Brooks, J., & Lewis, M. (1976). Infants' responses to strangers: Midget, adult, and child. *Educational Testing Service, 47*, 323–332.

Buijzen, M., Van der Molen, J. H. W., & Sondij, P. (2007). Parental mediation of children's emotional responses to a violent news event. *Communication Research, 34*, 212–230.

Buss, K. A. (2011). Which fearful toddlers should we worry about? Context, fear regulation, and anxiety risk. *Developmental Psychobiology, 47*, 804–819.

Buss, K. A., Davidson, R. J., Kalin, N. H., & Goldsmith, H. H. (2004). Context specific freezing and associated physiological reactivity as a dysregulated fear response. *Developmental Psychology, 40*, 583–594.

Cahill, L., & McGaugh, J. L. (1998). Mechanisms of emotional arousal and lasting declarative memory. *Trends in Neurosciences, 21*, 294–299.

Callaghan, B. L., & Richardson, R. (2013). Early experiences and the development of emotional learning systems in rats. *Biology of Mood & Anxiety Disorders, 127*, 703.

Campos, J. J., Anderson, D. I., Barbu-Roth, M. A., Hubbard, E. M., Hertenstein, M. J., & Witherington, D. (2000). Travel broadens the mind. *Infancy, 1*, 149–219.

Campos, J. J., Bertenthal, B. I., & Kermoian, R. (1992). Early experience and emotional development: The emergence of wariness of heights. *Psychological Science, 3*, 61–64.

Campos, J. J., Frankel, C. B., & Camras, L. (2004). On the nature of emotion regulation. *Child Development, 75*, 377–394.

Campos, J. J., Hiatt, S., Ramsay, D., Henderson, C., & Svejda, M. (1978). The emergence of fear on the visual cliff. In M. Lewis & L. Rosenblum (Eds.), *The development of affect* (pp. 149–182). New York, NY: Plenum Press.

Camras, L. A. (2011). Differentiation, dynamical integration, and functional emotional development. *Emotion Review, 3*, 138–146.

Camras, L. A., Oster, H., Bakeman, R., Meng, Z., Ujiie, T., & Campos, J. J. (2007). Do infants show distinct negative facial expressions for fear and anger? Emotional expression in 11-month-old European, American, Chinese, and Japanese infants. *Infancy, 11*, 131–155.

Camras, L. A., Oster, H., Campos, J. J., Miyake, K., & Bradshaw, D. (1992). Japanese and American infants' responses to arm restraint. *Developmental Psychology, 28*, 578–583.

Camras, L. A., & Shutter, J. M. (2010). Emotional facial expressions in infancy. *Emotion Review, 2*, 120–129.

Camras, L. A., Sullivan, J., & Michel, G. (1993). Adult judgments of facial, vocal, and body actions. *Journal of Nonverbal Behavior, 17*, 171–186.

Casey, B. J., Jones, R. M., & Hare, T. A. (2008). The adolescent brain. *Annals of the New York Academy of Sciences, 1124*, 111–126.

Clore, G. L., & Ortony, A. (2000). Cognition in emotion: Never, sometimes, or always. In R. D. Lane & L. Nadel (Eds.), *The cognitive neuroscience of emotion* (pp. 24–61). New York, NY: Oxford University Press.

Coan, J. A. (2010). Emergent ghosts of the emotion machine. *Emotion Review, 2*, 274–285.

Coan, J. A., Schaefer, H. S., & Davidson, R. J. (2006). Why we hold hands: Social regulation of the neural threat response. *Psychphysiology, 43*, 17.

Coelho, C. M., & Purkis, H. (2009). The origins of specific phobias: Influential theories and current perspectives. *Review of General Psychology, 31*, 335–348.

Cohn, J. F., Matias, R., Tronick, E. Z., Connell, D., & Lyons-Ruth, K. (1986). Face-to-face interactions of depressed mothers and their infants. *New Directions for Child and Adolescent Development, 34*, 31–45.

Cunningham, W. A., Dunfield, K. A., & Stillman, P. E. (2013). Emotional states from affective dynamics. *Emotion Review, 5*, 344–355.

Cunningham, W. A., & Zelazo, P. D. (2007). Attitudes and evaluations: A social cognitive neuroscience perspective. *Trends in Cognitive Sciences, 11*, 97–104.

Cunningham, W. A., & Zelazo, P. D. (2009). The development of iterative reprocessing: Implications for affect and its regulation. In P. D. Zelazo, M. Chandler, & E. A. Crone (Eds.), *Developmental social cognitive neuroscience* (pp. 81–98). Mahwah, NJ: Erlbaum.

de Haan, M., Belsky, J., Reid, V., Volein, A., & Johnson, M. H. (2004). Maternal personality and infants' neural and visual responsivity to facial expressions of emotion. *Journal of Child Psychology and Psychiatry, 45*, 1209–1218.

Davey, G. C. L. (1997). A conditioning model of phobias. In G. C. L. Davey (Ed.), *Phobias: A handbook of theory, research and treatment* (pp. 301–322). Chichester, UK: Wiley.

Davey, G. C. L. (2002). 'Nonspecific' rather than 'nonassociative' pathways to phobias: A commentary on Poulton and Menzies. *Behaviour Research and Therapy, 40*, 151–158.

Davis, F. C., Neta, M., Kim, M. J., Moran, J. M., & Whalen, P. J. (2016). Interpreting ambiguous social cues in unpredictable contexts. *Social Cognitive and Affective Neuroscience, 11*, 775–582.

Delgado, M. R., Li, J., Schiller, D., & Phelps, E. A. (2008). The role of the striatum in aversive learning and aversive prediction errors. *Philosophical Transactions of the Royal Society of London B: Biological Sciences, 363*(1511), 3787–3800.

Delgado, M. R., Olsson, A., & Phelps, E. A. (2006). Extending animal models of fear conditioning to humans. *Biological Psychology, 73*, 39–48.

Dollinger, S. J., O'Donnell, J. P., & Staley, A. A. (1984). Lightning-strike disaster: Effects on children's fears and worries. *Journal of Consulting and Clinical Psychology, 52*, 1028–1038.

Dubi, K., Rapee, R. M., Emerton, J. L., & Schniering, C. A. (2008). Maternal modeling and the acquisition of fear and avoidance in toddlers: Influence of stimulus preparedness and child temperament. *Journal of Abnormal Child Psychology, 36*, 499–512.

Dunsmoor, J. E., Mitroff, S. R., & LaBar, K. S. (2009). Generalization of conditioned fear along a dimension of increasing fear intensity. *Learning & Memory, 16*, 460–469.

Dunsmoor, J. E., Prince, S. E., Murthy, V. P., Kragel, P. A., & LaBar, K. S. (2011). Neurobehavioral mechanisms of human fear generalization. *NeuroImage, 55*, 1878–1888.

Dymond, S., Dunsmoor, J. E., Vervliet, B., Roche, B., & Hermans, D. (2015). Fear generalization in humans: Systematic review and implications for anxiety disorder research. *Behavior Therapy, 46*, 561–582.

Ekman, P. (1993). Facial expressions of emotion: New findings, new questions. *Psychological Science, 3*, 34–38.

Ekman, P., & Cordaro, D. (2011). What is meant by calling emotions basic. *Emotion Review, 3*, 364–370.

Ekman, P., & Friesen, W. V. (1971). Constants across cultures in the face and emotion. *Journal of Personality and Social Psychology, 17*, 124–129.

Ekman, P., & Oster, H. (1979). Facial expressions of emotion. *Annual Review of Psychology, 30*, 527–554.

Ellis, B. H., Fisher, P. A., & Zaharie, S. (2004). Predictors of disruptive behavior, developmental delays, anxiety, and affective symptomatology among institutionally reared romanian children. *Journal of the Amerian Academy of Child & Adolescent Psychiatry, 43*, 1283–1292.

Farroni, T., Menon, E., Rigato, S., & Johnson, M. H. (2007). The perception of facial expressions in newborns. *European Journal of Developmental Psychology, 4*, 2–13.

Ferrari, M. (1986). Fears and phobias in childhood: Some clinical and developmental considerations. *Child Psychiatry and Human Development, 17*, 75–87.

Field, A. P. (2006). Is conditioning a useful framework for understanding the development and treatment of phobias? *Clinical Psychology Review, 26*, 857–875.

Field, A. P., & Lawson, J. (2003). Fear information and the development of fears during childhood: Effects on implicit fear responses and behavioural avoidance. *Behaviour Research and Therapy, 41*, 1277–1293.

Field, A. P., Lawson, J., & Banerjee, R. (2008). The verbal threat information pathway to fear in children: The longitudinal effects on fear cognitions and the immediate effects on avoidance behavior. *Journal of Abnormal Psychology, 117*, 214–224.

Field, A. P., & Lester, K. J. (2010). Is there room for 'development' in developmental models of information processing biases to threat in children and adolescents? *Clinical Child and Family Psychology Review, 13*, 315–332.

Field, A. P., & Price-Evans, K. (2009). Temperament moderates the effect of the verbal threat information pathway on children's heart rate responses to novel animals. *Behaviour Research and Therapy, 47*, 431–436.

Field, A. P., & Purkis, H. M. (2011). The role of learning in the aetiology of child and adolescent fear and anxiety. In W. K. Silverman & A. P. Field (Eds.), *Anxiety disorders in children and adolescents: Research, assessment and intervention* (2nd ed., pp. 227–256). Cambridge, UK: Cambridge University Press.

Field, A. P., & Schorah, H. (2007). The verbal information pathway to fear and heart rate changes in children. *Journal of Child Psychology and Psychiatry, 48*, 1088–1093.

Field, A. P., & Storksen-Coulson, H. (2007). The interaction of pathways to fear in childhood anxiety: A preliminary study. *Behaviour Research and Therapy, 45*, 3051–3059.

Field, T. M. (1992). Infants of depressed mothers. *Development and Psychopathology, 4*, 49–66.

Field, T. M., Cohen, D., Garcia, R., & Greenberg, R. (1984). Mother-stranger face discrimination by the newborn. *Infant Behavior and Development, 7*, 19–25.

Field, T. M., Woodson, R., Greenberg, R., & Cohen, D. (1983). Facial expression by neonates. *Annual Progress in Child Psychiatry and Child Development, 16*, 119–125.

Forrester, M. B., & Stanley, S. K. (2004). Epidemiology of spider bites in Texas, 1998–2002. *Public Health, 118*, 506–507.

Gao, X., & Maurer, D. (2010). A happy story: Developmental changes in children's sensitivity to facial expressions of varying intensities. *Journal of Experimental Child Psychology, 107*, 67–86.

Gao, Y., Raine, A., Venables, P. H., Dawson, M. E., & Mednick, S. A. (2010). Reduced electrodermal fear conditioning from ages 3 to 8 years is associated with aggressive behavior at age 8 years. *Journal of Child Psychology and Psychiatry, 51*, 550–558.

Gee, D. G., Gabard-Durnam, L. J., Flannery, J., Goff, B., Humphreys, K. L., Telzer, E. H., … Tottenham, N. (2013). Early developmental emergence of human amygdala–prefrontal connectivity after maternal deprivation. *Proceedings of the National Academy of Sciences, 110*, 15638–15643, 201307893.

Gee, D. G., Humphreys, K. L., Flannery, J., Goff, B., Telzer, E. H., Shapiro, M., … Tottenham, N. (2013). A developmental shift from positive to negative connectivity in human amygdala–prefrontal circuitry. *Journal of Neuroscience, 33*, 4584–4593.

Gerull, F. C., & Rapee, R. M. (2002). Mother knows best: Effects of maternal modeling on the acquisition of fear and avoidance behavior in toddlers. *Behaviour Research and Therapy, 40*, 279–287.

Gilmore, J. H., Shi, F., Woolson, S. L., Knickmeyer, R. C., Short, S. J., Lin, W., … Shen, D. (2012). Longitudinal development of cortical and subcortical gray matter from birth to 2 years. *Cerebral Cortex, 22*, 2478–2485.

Goldsmith, H. H., & Rothbart, M. K. (1999). *The laboratory temperament assessment battery (Locomotor Version, Edition 3.1)*. Madison, WI: University of Wisconsin-Madison.

Hanson, J. L., Nacewicz, B. M., Sutterer, M. J., Cayo, A. A., Schaefer, S. M., Rudolph, K. D., … Davidson, R. J. (2015). Behavioral problems after early life stress: Contributions of the hippocampus and amygdala. *Biological Psychiatry, 77*, 314–323.

Hartley, C. A., & Phelps, E. A. (2010). Changing fear: The neurocircuitry of emotion regulation. *Neuropsychopharmacology, 35*, 136.

Hertenstein, M. J., & Campos, J. J. (2001). Emotion regulation via maternal touch. *Infancy, 2*, 549–566.

Hostinar, C. E., Sullivan, R. M., & Gunnar, M. R. (2014). Psychobiological mechanisms underlying the social buffering of the hypothalamic–pituitary–adrenocortical axis: A review of animal models and human studies across development. *Psychological Bulletin, 140*, 256–282.

Izard, C. E. (1990). Facial expressions and the regulation of emotions. *Journal of Personality and Social Psychology, 58*, 487–498.

Izard, C. E. (1994). Innate and universal facial expressions: Evidence from developmental and cross-cultural research. *Psychological Bulletin, 115*, 288–299.

Izard, C. E. (2007). Basic emotions, natural kinds, emotion schemas, and a new paradigm. *Perspectives on Psychological Science, 2*, 260–280.

Izard, C. E., Heubner, R. R., Risser, D., McGinnes, G. C., & Dougherty, L. M. (1980). The young infants' ability to produce discrete emotion expressions. *Developmental Psychology, 16*, 132–140.

Janak, P. H., & Tye, K. M. (2015). From circuits to behavior in the amygdala. *Nature, 517*(7534), 284–292.

Kagan, J. (1988). The idea of emotion in human development. In C. E. Izard, J. Kagan, & R. B. Zajonc (Eds.), *Emotions, cognition, and behavior* (p. 38). Cambridge, MA: Cambridge University.

Karasik, L. B., Tamis-LeMonda, C. S., & Adolph, K. E. (2016). Decisions at the brink: Locomotor experience affects infants' use of social information on an adjustable drop-off. *Frontiers in Psychology, 7*, 797.

Kasturiratne, A., Wickremasinghe, A. R., de Silva, N., Gunawardena, N. K., Pathmeswaran, A., Premaratna, R., … de Silva, H. J. (2008). The global burden of snakebite: A literature analysis and modeling based on regional estimates of envenoming and deaths. *PLoS Medicine, 5*(11), e218, 1591–e218, 1604.

Keltner, D., & Gross, J. J. (1999). Functional accounts of emotions. *Cognition & Emotion, 13*, 467–480.

Kim, M. J., & Whalen, P. J. (2009). The structural integrity of an amygdala-prefrontal pathway predicts trait anxiety. *Journal of Neuroscience, 29*, 11614–11618.

King, N. J., Eleonora, G., & Ollendick, T. H. (1998). Etiology of childhood phobias: Current status of Rachman's three pathways theory. *Behaviour Research and Therapy, 36*, 297–309.

Kleinknecht, R. A. (2002). Comments on: Non-associative fear acquisition: A review of the evidence from retrospective and longitudinal research. *Behaviour Research and Therapy, 40*, 159–163.

Klinnert, M. D. (1984). The regulation of infant behavior by maternal facial expression. *Infant Behavior and Development, 7*, 447–465.

Koster, E. H. W., Crombez, G., Van Damme, S., Verschuere, B., & De Houwer, J. (2004). Does imminent threat capture and hold attention? *Emotion, 4*, 312–317.

Kotsoni, E., de Haan, M., & Johnson, M. H. (2001). Categorical perception of facial expressions by 7-month-old infants. *Perception, 30*, 1115–1125.

Kretch, K. S., & Adolph, K. E. (2013). Cliff or step? Posture-specific learning at the edge of a drop-off. *Child Development, 84*, 226–240.

Kretch, K. S., Franchak, J. M., & Adolph, K. E. (2014). Crawling and walking infants see the world differently. *Child Development, 85*, 1503–1518.

Krol, K. M., Monakhov, M., San Lai, P., Ebstein, R. P., & Grossmann, T. (2015). Genetic variation in CD38 and breastfeeding experience interact to impact infants' attention to social eye cues. *Proceedings of the National Academy of Sciences, 112*, E5434–E5442.

LaBar, K. S., Gatenby, J. C., Gore, J. C., LeDoux, J. E., & Phelps, E. A. (1998). Human amygdala activation during conditioned fear aquisition and extinction: A mixed-trial fMRI study. *Neuron, 20*, 937–945.

Lang, P. J. (1968). Fear reduction and fear behavior: Problems in treating a construct. In J. M. Schlien (Ed.), *Research in psychotherapy* (Vol. 3, pp. 90–103). Washington, DC: American Psychological Association.

Lang, P. J., Davis, M., & Öhman, A. (2000). Fear and anxiety: Animal models and human cognitive psychophysiology. *Journal of Affective Disorders, 61*, 137–159.

Lau, J. Y., Britton, J. C., Nelson, E. E., Angold, A., Ernst, M., Goldwin, M., … Pine, D. S. (2011). Distinct neural signatures of threat learning in adolescents and adults. *Proceedings of the National Academy of Sciences, 108*, 4500–4505.

Lazarus, R. (1994). The stable and the unstable in emotion. In P. Ekman & R. J. Davidson (Eds.), *The nature of emotion: Fundamental questions* (pp. 79–85). Oxford, NY: Oxford University Press.

Lazarus, R. S. (1991). *Emotion and adaptation*. New York, NY: Oxford University Press.

LeDoux, J. (2012). Rethinking the emotional brain. *Neuron, 73*, 653–676.

Leppänen, J., Peltola, M. J., Mäntymaa, M., Koivuluoma, M., Salminen, A., & Puura, K. (2010). Cardiac and behavioral evidence for emotional influences on attention in 7-month-old infants. *International Journal of Behavioral Development, 34*, 547–553.

Leppänen, J. M., Moulson, M. C., Vogel-Farley, V. K., & Nelson, C. A. (2007). An ERP study of emotional face processing in the adult and infant brain. *Child Development, 78*, 232–245.

Lewis, M. (2013). *The rise of consciousness and the development of emotional life*. New York, NY: The Guilford Press.

Lewis, M., Brooks, J., & Haviland, J. (1978). Hearts and faces: A study in the measurement of emotion. In M. Lewis & L. A. Rosenblum (Eds.), *The development of affect* (pp. 77–123). Springer. Boston, MA.

Lewis, M., & Douglas, L. (1998). A dynamic systems approach to cognition-emotion interactions in development. In M. F. Mascolo & S. Griffin (Eds.), *What develops in emotional development* (pp. 159–188). New York, NY: Plenum Press.

Lewis, M., & Rosenblum, L. A. (1974). Introduction: The origins of fear. In M. Lewis & L. A. Rosenblum (Eds.), *The origins of behavior* (Vol. 2, pp. 1–10). New York, NY: Wiley.

LoBue, V. (2009). More than just a face in the crowd: Detection of emotional facial expressions in young children and adults. *Developmental Science, 12*, 305–313.

LoBue, V. (2010a). And along came a spider: Superior detection of spiders in children and adults. *Journal of Experimental Child Psychology, 107*, 59–66.

LoBue, V. (2010b). What's so scary about needles and knives? Examining the role of experience in threat detection. *Cognition and Emotion, 24*, 80–87.

LoBue, V. (2013). What are we so afraid of? How early attention shapes our most common fears. *Child Development Perspectives, 7*, 38–42.

LoBue, V. (2014). Deconstructing the snake: The relative roles of perception, cognition, and emotion on threat detection. *Emotion, 14*, 701–711.

LoBue, V. (2016). When is a face no longer a face? A problematic dichotomy in visual detection research. *Emotion Review, 8*, 250–257.

LoBue, V., & Adolph, K. E. (2019, in press). Fear in infancy: Lessons from strangers, heights, snakes, spiders, and other scary stuff. *Developmental Psychology.*

LoBue, V., Buss, K. A., Taber-Thomas, B. C., & Pérez-Edgar, K. (2017). Developmental differences in infants' attention to social and non-social threats. *Infancy, 22*, 403–415.

LoBue, V., & DeLoache, J. S. (2008). Detecting the snake in the grass: Attention to fear relevant stimuli by adults and young children. *Psychological Science, 19*, 284–289.

LoBue, V., & DeLoache, J. S. (2010). Superior detection of threat-relevant stimuli in infancy. *Developmental Science, 13*, 221–228.

LoBue, V., & DeLoache, J. S. (2011). What so special about slithering serpents? Children and adults rapidly detect snakes based on their simple features. *Visual Cognition, 19*, 129–143.

LoBue, V., & Larson, C. L. (2010). What makes angry faces look so…angry? Examining visual attention to the shape of threat in children and adults. *Visual Cognition, 18*, 1165–1178.

LoBue, V., & Pérez-Edgar, K. (2014). Sensitivity to social and non-social threats in temperamentally shy children at-risk for anxiety. *Developmental Science, 17*, 239–247.

LoBue, V., & Rakison, D. (2013). What we fear most: A developmental advantage for threat-relevant stimuli. *Developmental Review, 33*, 285–303.

LoBue, V., Rakison, D., & DeLoache, J. S. (2010). Threat perception across the lifespan: Evidence for multiple converging pathways. *Current Directions in Psychological Science, 19*, 375–379.

Malatesta, C. Z., & Haviland, J. M. (1982). Learning display rules: The socialization of emotion expression in infancy. *Child Development, 53*, 991–1003.

Marks, I. (2002). Innate and learned fears are at opposite ends of a continuum of associability. *Behaviour Research and Therapy, 40*, 165–167.

Marks, I. M. (1987). *Fears, phobias, and rituals*. New York, NY: Oxford University Press.

Marks, I. M., & Nesse, R. M. (1994). Fear and fitness: An evolutionary analyses of anxiety disorders. *Ethology and Sociobiology, 15*, 247–261.

Masten, C. L., Telzer, E. H., Fuligni, A. J., Lieberman, M. D., & Eisenberger, N. I. (2012). Time spent with friends in adolescence relates to less neural sensitivity to later peer rejection. *Social Cognitive and Affective Neuroscience, 7*, 106–114.

McNally, R. J. (2002). On nonassociative fear emergence. *Behaviour Research and Therapy, 40*, 169–172.

Meiser-Stedman, R. (2002). Towards a cognitive-behavioral model of PTSD in children and adolescents. *Clinical Child and Family Psychology Review, 5*, 217–232.

Meiser-Stedman, R., Smith, P., Glucksman, E., Yule, W., & Dalgleish, T. (2008). The posttraumatic stress disorder diagnosis in preschool- and elementary school-age children exposed to motor vehicle accidents. *American Journal of Psychiatry, 165*, 1326–1337.

Menzies, R. G., & Clarke, J. C. (1995). The etiology of phobias: A nonassociative account. *Clinical Psychology Review, 15*, 23–48.

Merckelbach, H., Muris, P., & Schouten, E. (1996). Pathways to fear in spider phobic children. *Behaviour Research and Therapy, 34*, 935–938.

Milders, M., Sahraie, S., Logan, S., & Donnellon, N. (2006). Awareness of faces is modulated by their emotional meaning. *Emotion, 6*, 10–17.

Mineka, S., & Zinbarg, R. (2006). A contemporary learning theory perspective on the etiology of anxiety disorders: it's not what you thought it was. *American Psychologist, 61*(1), 10.

Morales, S., Fu, X., & Pérez-Edgar, K. E. (2016). A developmental neuroscience perspective on affect-biased attention. *Developmental Cognitive Neuroscience, 21*, 26–41.

Mumme, D. L., & Fernald, A. (2003). The infant as onlooker: Learning from emotional reactions observed in a television scenario. *Child Development, 74*, 221–237.

Mumme, D. L., Fernald, A., & Herrera, C. (1996). Infants' responses to facial and vocal emotional signals in a social referencing paradigm. *Child Development, 67*, 3219–3237.

Muris, P., Bodden, D., Merckelbach, H., Ollendick, T. H., & King, N. (2003). Fear of the beast: A prospective study on the effects of negative information on childhood fear. *Behaviour Research and Therapy, 41*, 195–208.

Muris, P., & Field, A. P. (2010). The role of verbal threat information in the development of childhood fear. "Beware the Jabberwock!". *Clinical Child and Family Psychology Review, 13*, 129–150.

Muris, P., & Field, A. P. (2011). The normal development of fear in children and adolescents. In W. K. Silverman & A. P. Field (Eds.), *Anxiety disorders in children and adolescents: Research, assessment and intervention* (2nd ed., pp. 76–89). Cambridge: Cambridge University Press.

Muris, P., Merckelbach, H., de Jong, P. J., & Ollendick, T. H. (2002). The etiology of specific fears and phobias in children: A critique of the non-associative account. *Behaviour Research and Therapy, 40*, 185–195.

Muris, P., Merckelbach, H., Gadet, B., & Moulaert, V. (2000). Fears, worries, and scary dreams in 4-to 12-year-old children: Their content, developmental pattern, and origins. *Journal of Clinical Child Psychology, 29*, 43–52.

Nelson, C. A., & De Haan, M. (1996). Neural correlates of infants' visual responsiveness to facial expressions of emotion. *Developmental Psychobiology, 29*, 577–595.

Nelson, C. A., Morse, P. A., & Leavitt, L. A. (1979). Recognition of facial expressions by seven-month-old infants. *Child Development, 50*, 1239–1242.

Nesse, R. M., Curtis, G. C., Thyer, B. A., McCann, D. S., Huber-Smith, M. J., & Knopf, R. F. (1985). Endocrine and cardiovascular responses during phobic anxiety. *Psychosomatic Medicine, 47*, 320–332.

Neta, M., Cantelon, J., Haga, Z., Mahoney, C. R., Taylor, H. A., & Davis, F. C. (2017). The impact of uncertain threat on affective bias: Individual differences in response to ambiguity. *Emotion, 17*, 1137.

Ochsner, K. N., & Gross, J. J. (2005). The cognitive control of emotion. *Trends in Cognitive Sciences, 9*(5), 242–249.

Ollendick, T. H. (1983). Reliability and validity of the revised fear survey schedule for children (FSSC-R). *Behaviour Research and Therapy, 21*, 685–692.

Ollendick, T. H., & King, N. J. (1991). Origins of childhood fears: An evaluation of Rachman's theory of fear acquisition. *Behaviour Research and Therapy, 29*, 117–123.

Ollendick, T. H., Yang, B., Dong, Q., Xia, Y., & Lin, L. (1995). Perceptions of fear in other children and adolescents: The role of gender and friendship status. *Journal of Abnormal Child Psychology, 23*, 439–452.

Olsson, A., Nearing, K. I., & Phelps, E. A. (2007). Learning fears by observing others: The neural systems of social fear transmission. *Social Cognitive and Affective Neuroscience, 2*, 3–11.

Oster, H., Hegley, D., & Negel, L. (1992). Adult judgments and fine-grained analysis of infant facial expressions: Testing the validity of a priori coding formulas. *Developmental Psychology, 28*, 1115–1131.

Öhman, A., Dimberg, U., & Öst, L. G. (1985). Animal and social phobias: Biological constraints on learned fear responses. In S. Reiss & R. R. Bootzin (Eds.), *Theoretical issues in behavior therapy*. Orlando, FL: Academic Press.

Öhman, A., Flykt, A., & Esteves, F. (2001). Emotion drives attention: Detecting the snake in the grass. *Journal of Experimental Psychology: General, 13*, 466–478.

Öhman, A., Lundqvist, D., & Esteves, F. (2001). The face in the crowd revisited: An anger superiority effect with schematic faces. *Journal of Personality and Social Psychology, 80*, 381–396.

Öhman, A., & Mineka, S. (2001). Fears, phobias, and preparedness: Toward and evolved module of fear and fear learning. *Psychological Review, 108*, 483–522.

Panksepp, J. (2007). Neurologizing the psychology of affects: How appraisal-based constructivism and basic emotion theory can coexist. *Perspectives on Psychological Science, 2*, 281–296.

Panksepp, J. (2008). The affective brain and core consciousness: How does neural activity generate emotional feelings. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 47–67). New York, NY: Guildord Press.

Peltola, M. J., Leppänen, J. M., Mäki, S., & Hietanen, J. K. (2009). Emergence of enhanced attention to fearful faces between 5 and 7 months of age. *Social Cognitive and Affective Neuroscience, 4*, 134–142.

Peltola, M. J., Leppänen, J. M., Palokangas, T., & Hietanen, J. K. (2008). Fearful faces modulate looking duration and attention disengagement in 7-month-old infants. *Developmental Science, 11*, 60–68.

Peltola, M. J., Leppänen, J. M., Vogel-Farley, V. K., Hietanen, J. K., & Nelson, C. A. (2009). Fearful faces but not fearful eyes alone delay attention disengagement in 7-month-old infants. *Emotion, 9*, 560–565.

Pérez-Edgar, K., Bar-Haim, Y., McDermott, J. M., Chronis-Tuscano, A., Pine, D. S., & Fox, N. A. (2010). Attention biases to threat and behavioral inhibition in early childhood shape adolescent social withdrawal. *Emotion, 10*, 349–357.

Pérez-Edgar, K., Morales, S., LoBue, V., Taber-Thomas, B. C., Allen, K. M., Brown, K. M., & Buss, K. A. (2017). The impact of negative affect on attention patterns to threat across the first two years of life. *Developmental Psychology, 53*, 2219–2232.

Pérez-Edgar, K., Reeb-Sutherland, B. C., McDermott, J. M., White, L. K., Henderson, H. A., Degnan, K. A., … Fox, N. A. (2011). Attention biases to threat link behavioral inhibition to social withdrawal over time in very young children. *Journal of Abnormal Child Psychology, 39*, 885–895.

Phelps, E. A., Delgado, M. R., Nearing, K. I., & LeDoux, J. E. (2004). Extinction learning in humans: Role of the amygdala and vmPFC. *Neuron, 43*, 897–905.

Phelps, E. A., & LeDoux, J. E. (2005). Contributions of the amygdala to emotion process: From animal models to human behavior. *Neuron, 48*, 175–187.

Phelps, E. A., O'Connor, K. J., Gatenby, J. C., Gore, J. C., Grillon, C., & Davis, M. (2001). Activation of the left amygdala to a cognitive representation of fear. *Nature Neuroscience, 4*, 437.

Poulton, R., Davies, S., Menzies, R. G., Langley, J. D., & Silva, P. A. (1998). Evidence for a non-associative model of the acquisition of a fear of heights. *Behaviour Research and Therapy, 36*, 537–544.

Poulton, R., & Menzies, R. G. (2002). Non-associative fear-acquisition: A review of the evidence form retrospective and longitudinal research. *Behaviour Research and Therapy, 40*, 127–149.

Price-Evans, K., & Field, A. P. (2008). A neglectful parenting style moderates the effect of the verbal threat information pathway on children's heart rate responses to novel animals. *Behavioural and Cognitive Psychotherapy, 36*, 473–482.

Purkis, H. M., & Lipp, O. V. (2009). Are snakes and spiders special? Acquisition of negative valence and modified attentional processing by non-fear-relevant animal stimuli. *Cognition & Emotion, 23*, 430–452.

Rachman, S. J. (1977). The conditioning theory of fear acquisition: A critical examination. *Behaviour Research and Therapy, 15*, 375–387.

Rachman, S. J. (2002). Fears born and bred: Non-associative fear acquisition? *Behaviour Research and Therapy, 40*, 121–126.

Reissland, N., Francis, B., Mason, J., & Lincoln, K. (2011). Do facial expressions develop before birth? *PLoS One, 6*, e24081.

Reynolds, G., Askew, C., & Field, A. P. (2018). Behavioral inhibition and the associative learning of fear. In *Behavioral inhibition* (pp. 263–282). Cham, Switzerland: Springer.

Ricciuti, H. (1974). Fear and the development of social attachment in the first year of life. In M. Lewis & L. A. Rosenblum (Eds.), *The origins of fear* (Vol. 2, pp. 73–106). New York, NY: Wiley.

Roozendaal, B., McReynolds, J. R., Zee, E. A. V. d., Lee, S., McGaugh, J. L., & McIntyre, C. K. (2009). Glucocorticoid effects on memory consolidation depend on functional interactions between the medial prefrontal cortex and basolateral amygdala. *Journal of Neuroscience, 29*, 14299–14308.

Saarni, C., Campos, J. J., Camras, L. A., & Witherington, D. (2006). Emotional development: Action, communication, and understanding. In N. Einsenberg (Ed.), *Handbook of child psychology. Vol. 3. Social, emotional, and personality development* (6th ed., pp. 226–299). New York, NY: Wiley.

Schiller, D., & Delgado, M. R. (2010). Overlapping neural systems mediating extinction, reversal and regulation of fear. *Trends in Cognitive Sciences, 14*, 268–276.

Schiller, D., Levy, I., Niv, Y., LeDoux, J. E., & Phelps, E. A. (2008). From fear to safety and back: Reversal of fear in the human brain. *Journal of Neuroscience, 28*, 11517–11525.

Schwartz, G. M., Izard, C. E., & Ansul, S. E. (1985). The 5-month-old's ability to discriminate facial expressions of emotion. *Infant Behavior and Development, 8*, 65–77.

Seligman, M. (1971). Phobias and preparedness. *Behavior Therapy, 2*, 307–320.

Serrano, J. M., Iglesias, J., & Loeches, A. (1992). Visual discrimination and recognition of facial expressions of anger, fear, and surprise in 4-to 6-month-old infants. *Developmental Psychobiology, 25*, 411–425.

Silvers, J. A., Insel, C., Powers, A., Franz, P., Helion, C., Martin, R. E., … Ochsner, K. N. (2017). vlPFC–vmPFC–amygdala interactions underlie age-related differences in cognitive regulation of emotion. *Cerebral Cortex, 27*, 3502–3514.

Slater, A. M., & Quinn, P. C. (2012). *Developmental psychology: Revisiting the classic studies*. London, UK: Sage Publications.

Smith, P. K. (1974). Social and situational determinants of fear in the playground. In M. Lewis & L. A. Rosenblum (Eds.), *The origins of fear* (Vol. 2, pp. 107–129). New York, NY: Wiley.

Sorce, J. F., Emde, R. N., Campos, J. J., & Klinnert, M. D. (1985). Maternal emotional signaling: Its effect on the visual cliff behavior of 1-year-olds. *Developmental Psychology, 21*, 195.

Sroufe, L. A. (1997). *Emotional development: The organization of emotional life in the early years*. Cambridge, MA: Cambridge University Press.

Swanson, L. W., & Petrovich, G. D. (1998). What is the amygdala? *Trends in Neurosciences, 22*, 207.

Tamis-LeMonda, C. S., Adolph, K. E., Lobo, S. A., Karasik, L. B., Ishak, S., & Dimitropoulou, K. A. (2008). When infants take mothers' advice: 18-month-olds integrate perceptual and social information to guide motor action. *Developmental Psychology, 44*, 734–746.

Thomas, K. M., Drevets, W. C., Whalen, P. J., Eccard, C. H., Dahl, R. E., Ryan, N. D., & Casey, B. J. (2001). Amygdala response to facial expressions in children and adults. *Biological Psychiatry, 49*, 309–316.

Thomas, L. A., De Bellis, M. D., Graham, R., & LaBar, K. S. (2007). Development of emotional facial recognition in late childhood and adolescence. *Developmental Science, 10*, 547–558.

Thrasher, C., & LoBue, V. (2016). Do infants find snakes aversive? Infants' physiological responses to "fear-relevant" stimuli. *Journal of Experimental Child Psychology, 142*, 382–390.

Tottenham, N. (2015). Social scaffolding of human amygdala-mPFCcircuit development. *Social Neuroscience, 10*, 489–499.

Tottenham, N., & Gabard-Durnam, L. J. (2017). The developing amygdala: A student of the world and a teacher of the cortex. *Current Opinion in Neurobiology, 17*, 55–60.

Trickey, D., Siddaway, A. P., Meiser-Stedman, R., Serpell, L., & Field, A. P. (2012). A meta-analysis of risk factors for post-traumatic stress disorder in children and adolescents. *Clinical Psychology Review, 32*, 122–138.

Ueno, M., Uchiyama, I., Campos, J. J., Dahl, A., & Anderson, D. I. (2011). The organization of wariness of heights in experienced crawlers. *Infancy, 17*, 376–392.

Urry, H. L., Reekum, C. M. V., Johnstone, T., Kalin, N. H., Thurow, M. E., Schaefer, H. S., … Davidson, R. J. (2006). Amygdala and ventromedial prefrontal cortex are inversely coupled during regulation of negative affect and predict the diurnal pattern of cortisol secretion among older adults. *Journal of Neuroscience, 26*, 4415–4425.

Vaish, A., Grossmann, T., & Woodward, A. (2008). Not all emotions are created equal: The negativity bias in social-emotional development. *Psychological Bulletin, 134*, 383–403.

Watson, J. B., & Rayner, R. (1920). Conditioned emotional reactions. *Journal of Experimental Psychology, 3*, 1–14.

Westenberg, P., Drewes, M. J., Goedhart, A. W., Siebelink, B. M., & Treffers, P. D. (2004). A developmental analysis of self-reported fears in late childhood through mid-adolescence: Social-evaluative fears on the rise? *Journal of Child Psychology and Psychiatry, 45*, 481–495.

Widen, S. C. (2013). Children's interpretation of facial expressions: The long path from valence-based to specific discrete categories. *Emotion Review, 5*, 72–77.

Widen, S. C., & Russell, J. A. (2003). A closer look at preschoolers' freely produced labels for facial expressions. *Developmental Psychology, 39*, 114–128.

Widen, S. C., & Russell, J. A. (2008). Children acquire emotion categories gradually. *Cognitive Development, 23*, 291–312.

Witherington, D. C., & Crichton, J. A. (2007). Frameworks for understanding emotions and their development: Functionalist and dynamic systems approaches. *Emotion, 7*, 628–637.

Young-Browne, G., Rosenfeld, H. M., & Horowitz, F. D. (1977). Infant discrimination of facial expressions. *Child Development, 48*, 555–562.

Yule, W., Udwin, O., & Murdoch, K. (1990). The 'Jupiter' sinking: Effects in children's fears, depression and anxiety. *Journal of Child Psychology and Psychiatry, 31*, 1051–1061.

Developing Disgust: Theory, Measurement, and Application

Joshua Rottman, Jasmine DeJesus, and Heather Greenebaum

Abstract

Disgust is a complex and uncharacteristic emotion. Despite being frequently classified as a "basic" emotion, disgust has a wide range of elicitors, many competing functional theories, and a protracted developmental trajectory. This chapter first reviews several ultimate explanations of disgust, highlighting how scholars historically privileged symbolic explanations, while most contemporary researchers believe disgust to be an adaptive pathogen avoidance mechanism. After a brief discussion of techniques for measuring disgust, we describe the current knowledge of the development of disgust, with special attention to the ways in which disgust influences food choice and contributes to contamination sensitivity. While certain aspects of disgust may be universal, its emergence is largely enculturated and its expression is highly variable. We conclude by discussing the ways in which the study of disgust carries practical implications for the diagnosis and treatment of psychopathologies, for nutrition, and for the implementation of public health initiatives. Although scholarly interest in disgust has greatly increased during recent years, there is still much room for further exploration of this enigmatic emotion.

Jessica feels nauseous at the smell of putrid beef and decides not to eat it, thus saving herself from a potentially fatal case of botulism. Michael feels revulsion toward two men kissing, and this leads him to shout obscenities in their direction. Their infant daughter, Amy, lacks a deep appreciation for either experience, but over the course of her childhood, she will gradually develop the multifaceted capacity to experience disgust across a wide range of situations. How will this trajectory unfold, and what functions will this new competence serve? What stimuli will begin to elicit disgust in Amy, and how can we be certain that she is experiencing revulsion rather than trepidation or annoyance? What consequences will feelings of disgust have for Amy's life and for the lives of those around her? In this chapter, we explore the current knowledge that can be brought to bear on these and related questions.

J. Rottman (✉)
Franklin and Marshall College,
Department of Psychology, Lancaster, PA, USA
e-mail: jrottman@fandm.edu

J. DeJesus
University of North Carolina at Greensboro,
Department of Psychology, Greensboro, NC, USA

H. Greenebaum
University of Pennsylvania, School of Social Policy and Practice, Philadelphia, PA, USA

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_12

Defining Disgust

Disgust is generally classified as one of six basic emotions; it is claimed to have a unique adaptive function, a distinctive neural substrate producing an inimitable phenomenology, and a characteristic facial expression that is recognized in disparate cultures around the world (Ekman, 1992; Izard, 1994). This characterization has been recently challenged with the advent of the constructionist paradigm, which considers emotions to arise from situation-specific combinations of more rudimentary psychological states (Barrett, 2017). Arguments against the universality and discreteness of disgust typically invoke findings that the prototypical disgust expression is not recognized as such around the world (Russell, 1994) and also invoke demonstrations that claims about the neural localization of disgust (and other "basic" emotions) have been overstated (Lindquist, Wager, Kober, Bliss-Moreau, & Barrett, 2012). Some have even claimed that disgust is more appropriately characterized as a feeling or a basic drive, thus being more akin to states like hunger or pain than to true emotions like anger or fear. In particular, its reflexive triggering by concrete elicitors and its cognitive impenetrability contrasts with the profile of other emotions, which typically have abstract elicitors and flexible responses that are somewhat amenable to reason (Royzman & Sabini, 2001).

Furthering the case for disgust being difficult to circumscribe, disgust serves multiple functions and cannot be easily classified as a unitary emotion (Simpson, Carter, Anthony, & Overton, 2006; Strohminger, 2014; Wilson, 2002; Yoder, Widen, & Russell, 2016). Additionally, disgust is not often experienced in isolation. Instead, it is frequently concomitant with other negative emotions, such as fear (Muris, Mayer, Borth, & Vos, 2013; Muris, Mayer, Huijding, & Konings, 2008), anxiety (Viar-Paxton et al., 2015), and anger (Nabi, 2002; Russell & Giner-Sorolla, 2013), and it may frequently blend into these other emotional states. Although generally characterized as having negative valence, disgusting objects are sometimes a source of fascination and even pleasure, as exemplified by dirty jokes and grotesque forms of art (Bloom, 2004; Strohminger, 2014).

Additionally, researchers disagree about the necessary and sufficient features of disgust. Some scholars liberally define disgust as any psychological mechanism that functions to prevent contact with parasites and thus extend the capacity across a vast range of animal species (e.g., Curtis, 2013). Most other scholars argue that disgust is considerably more complex and specific and should be distinguished from behavioral avoidance or mere distaste. This more common view suggests that disgust involves a range of sophisticated cognitive appraisals and a particular phenomenological state that is likely unique to humans (e.g., Kelly, 2011; Rozin, Haidt, & McCauley, 2016).

In this chapter, we will generally adhere to conventional practice by treating disgust as if it were a singular, distinguishable emotion that is largely constrained to humans. However, readers should remain aware that this treatment will gloss over some of the difficulties involved in differentiating disgust from other affective states, as well as disagreements about the phylogenetic recency of the emotion. We will review the current state of knowledge on the proximate and ultimate origins of disgust, while identifying key areas for application and future exploration. Because empirical research on the development of disgust has proceeded primarily from particular theoretical stances on its adaptive nature, we will first review the classic and modern perspectives on the function of disgust.

Theories of Disgust

Scholarly investigations into disgust have identified a rich variety of theorized origins and functions of this emotion. Many of these theories characterize disgust as emanating from conceptual considerations about highly abstract construals of the eliciting stimuli. According to these theories, it is not the physical nature of pus, rot, feces, and other forms of slime and ooze that directly trigger disgust, but rather the symbolic meaning that is socially affixed to these substances (see Royzman & Sabini, 2001). More recent theories instead focus on the direct ties

between the physical nature of disgust elicitors and their direct relevance for biological fitness (see Curtis, 2013). Here, we briefly review this theoretical landscape.

Disgust as a Mechanism for Disavowing Desired Objects

The study of disgust is one remaining bastion of psychology in which it would be amiss to not give credit to Sigmund Freud in a general overview. Freud argued that disgust was a central product of civilization and cultural norms, directly resulting from features that differentiate humans from other animals – in particular, the upright posture that places our eyes and noses further from the sights and smells of reproductive and excretory organs (see Menninghaus, 2003). Freud's astute observation that bipedalism reduces contact with urine, menstrual blood, feces, and sexual organs led him to the much more tenuous inference that humans must consistently suppress the purported sexual stimulation that bodily fluids and orifices elicit, thus producing repression and neurosis and giving rise to societal taboos involving bodily functions (Freud, 1905/2017).

Freud characterized children's fascination with their feces and their pleasure in excretion as a major facet of toddlerhood (Freud, 1905/2017). According to Freud's psychosexual theory of development, children must learn to control these libidinous urges when they undergo toilet training, as they are no longer able to obtain immediate erogenous pleasure by excreting at will. Thus, the anal stage is partially characterized by acquiring the disgust response as a reaction formation involved in the rejection of anal pleasure (Freud, 1905/2017). Freud's prediction that toilet training is a central experience in the acquisition of the disgust response, while still compelling to some (e.g., Rozin et al., 2016; Rozin & Fallon, 1987), has remained largely untested. In general, while Freud's psychodynamic analysis of disgust has been eschewed (along with most of his other ideas), his ideas were influential for many theorists who focused on the symbolic nature of the emotion (e.g., Kolnai, 1929/2004).

According to Freud's view that disgust is a neurotic symptom of suppressing sexual motives, disgust would be expected to be entirely absent at birth and would then begin to emerge as a defensive process during the first few years of life, specifically as a reaction formation produced by repressed sexual excitation during the earliest stages of development. By the time the superego develops early in childhood, thus burdening the child with the restrictive expectations of civilization, disgust should be fully intact – and this emotion should be particularly exacerbated for individuals with extreme repression of their base desires.

Disgust as a Response to "Matter Out of Place"

Mary Douglas' classic work *Purity and Danger* (1966) paralleled Freud's conviction that disgust was a product of socialization but instead argued that disgust operates in order to repel people from the symbolic threat of disorder. Specifically, Douglas suggested that the realm of disgust is simply anything that disrupts the particular order that exists within a given social or ecological system. According to Douglas, the long list of dietary restrictions in Leviticus can be explained by reactions to anomalous objects that pose contradictions or threats to classification systems with which we are comfortable. For instance, Douglas points out that most ruminants have cloven hooves and also chew their cud and suggests that the anomaly of having one but not both of these category-defining features – as is the case for pigs and camels – leads an animal to be considered disgusting and forbidden from consumption. Similarly, because we think of birds as prototypical flying creatures and fish as prototypical swimming creatures, insects and eels disgust us because they fly and swim in ways that significantly depart from these taxonomic exemplars. While Douglas' (1966) idea has stirred the imagination of many scholars during the past half-century, the theory has not gained much empirical support. Exceptions abound; sugar gliders and dolphins present anomalies similar to

insects and eels, and yet are generally regarded as adorable, and many other category violations (e.g., animals dressed as people) are weird but not disgusting (Bloom, 2004). Douglas' theory does not make clear developmental predictions, although it could be posited that disgust should develop alongside categorical reasoning, which begins to emerge during the first year of life (see Rakison & Oakes, 2003).

Disgust as an Existential Barrier

Seen through the lens of the terror management theory, disgust is thought to protect humans from confronting the horrors of mortality (Becker, 1973; Goldenberg et al., 2001). According to this view, disgust helps people to avoid existential fears of death and the confrontation of a disordered, threatening world that is constantly spiraling into greater entropy and ambiguity. Disgust is thus thought to shield us from our vulnerabilities and to prevent us from seeing ourselves as mere animals (Herz, 2012; Miller, 1997; Nussbaum, 2004). This theory suggests that disgust regulates the boundaries of the self, explaining why it tends to be experienced when the borders of the body are breached, since exposing our biological insides causes us to realize that we have fundamental similarities with other animals – including having an ephemeral existence. This theory also posits that people find decomposing material, including human bodies and animal flesh, disgusting because they serve as a potent reminder of human mortality (Rozin et al., 2016). However, recent empirical evidence does not bear out the predictions of this theory, indicating that reminders of our mortal, animal natures (i.e., being told: "Human beings … are born, eat, procreate, live, and eventually die like any other animal") do not actually elicit disgust (Kollareth & Russell, 2017). There have been no clear developmental predictions made by proponents of the theory that disgust helps us to avoid confronting our animal nature. However, given that children both understand and fear death by 5–7 years of age (Slaughter & Griffiths, 2007; Speece & Brent, 1984), it is likely that disgust would be hypothesized to emerge as a helpful psychological tool by this point in development.

Disgust as Rejecting Offensive Substances

Building from the idea that disgust protects the bodily self, Rozin and colleagues have suggested that disgust may primarily facilitate the oral rejection of offensive, contaminating substances (e.g., Rozin & Fallon, 1987). The etymology of disgust suggests that it functions to prevent bad tastes, and accordingly some have proposed that disgust emerged from distaste (i.e., the visceral reaction to experienced bitter tastes) as a way of rejecting orally ingested substances that are cognitively appraised as contaminants or toxins (Darwin, 1872/1965; Rozin et al., 2016). This is reminiscent of Angyal's (1941) theory proposing that disgust primarily functioned to prevent the ingestion of bodily waste, as these substances are perceived as debased or dangerous to consume. The idea that disgust is primarily a guardian of the mouth is supported by evidence that the classic "gape face" and feelings of nausea associated with the disgust response present clear mechanisms for expelling contaminants from the oral cavity (Darwin, 1872/1965), and aversive reactions are most intensely experienced when undesirable substances enter the mouth as opposed to contacting other parts of the body (Rozin, Nemeroff, Horowitz, Gordon, & Voet, 1995).

Most proponents of this theory argue that substances can be regarded as gross for conceptual reasons related to the history of the substance, rather than solely on the substance's perceivable sensory qualities. For example, survey research has found that a number of Americans have a strong disgust reaction toward purified wastewater and express that they would be absolutely unwilling to drink it even if it is made substantially more germ-free than typical bottled water (Rozin, Haddad, Nemeroff, & Slovic, 2015). Furthering the notion that contamination can exist at a highly abstract level, adults are hesitant to wear clothing that previously belonged to a sick or evil source (e.g., Hitler), even when they acknowledge that no actual germs would be transmitted (Nemeroff & Rozin, 1994). Thus, disgust is not specifically attuned to physical dangers, but extends to ideational harms. Again, this theory

makes no clear predictions about the developmental trajectory of disgust, except that it likely requires the sophisticated ability to conceptualize abstract notions of "offensiveness" and some form of social learning (see Rozin et al., 2016).

Disgust as Preventing Pathogens

As the study of disgust has gained broad traction, so has the argument that disgust should be explained by its adaptive, rather than symbolic, significance. The theory that disgust functions primarily as a disease avoidance response has become more prominent in recent years (Curtis, 2013; Curtis, de Barra, & Aunger, 2011; Oaten, Stevenson, & Case, 2009). According to this increasingly dominant view, disgust serves as a primary behavioral support mechanism for the human immune system. Behaviors promoting pathogen avoidance – such as migrating to clean pastures, avoiding sick prey, and grooming – can be observed throughout the animal kingdom (e.g., Hart, 1990; Kiesecker, Skelly, Beard, & Preisser, 1999; see Curtis, 2014; Curtis et al., 2011). This is particularly the case for avoiding diseased conspecifics, as these are the most common source of infection (see Curtis, 2014; Fincher & Thornhill, 2012). However, it is possible that the human response to disease vectors has unique features. One possibility is that, while adaptations for avoiding poisons and adaptations for avoiding pathogens are both present throughout the animal kingdom, they have been fused into a single psychological mechanism only in the human species (Kelly, 2011). Because harmful pathogens are too small to be directly perceived, people must rely on indirect and imperfect sensory cues of their existence, such as noxious smells, slimy textures, morphological abnormalities, and observable behavioral symptoms of disease (Curtis, 2013; Kurzban & Leary, 2001; Park, Schaller, & Crandall, 2007). The desire to avoid these indirect indications of the presence of pathogens must be weighed against the potential benefits from coming in contact with other individuals, ranging from basic social affiliation to procreation (Tybur & Lieberman, 2016).

This pathogen avoidance theory is well supported by evidence that many substances that trigger disgust are associated with veridical threats of infectious disease (Curtis, 2011). This includes other people who are perceived to be unhealthy or unhygienic based on morphological asymmetries or disfigurements, which could be overgeneralized responses to typical signs of disease (Oaten, Stevenson, & Case, 2011). One study presented nearly 40,000 participants (primarily from the United Kingdom) with pairs of matched images that either did or did not contain disease-relevant features and found that the photographs with disease vectors (e.g., lesions and bodily secretions) were rated as more disgusting than the matched controls (Curtis, Aunger, & Rabie, 2004), suggesting that humans have the capacity to detect real disease threats and that these cues tend to elicit disgust. Nonetheless, the reliance on indirect cues to the presence of pathogens leaves open the possibility for both misses and false alarms.

Despite the compelling and intuitive link between disgust elicitors and disease vectors, there is less evidence for this theory at the level of individual differences. Specifically, there is only mixed evidence of a relationship between individuals' tendencies to experience disgust and their susceptibility to pathogen-borne illnesses. One study of Australian undergraduates found a weak positive correlation between a general propensity to experience disgust and the incidence of contracting infectious diseases (Stevenson, Case, & Oaten, 2009), but a similar study of young adults living in rural Bangladesh failed to find any association between disgust sensitivity and the frequency of infections contracted in either childhood or adulthood (de Barra, Islam, & Curtis, 2014). Another study has found a modest correlation between undergraduates' disgust sensitivity and their feelings that they are vulnerable to contracting harmful pathogens (Tybur, Lieberman, & Griskevicius, 2009).

There is some disagreement about the developmental predictions of the pathogen avoidance account of disgust. Some argue that it should take several years for disgust to emerge because children need to come into contact with a range

of pathogens in order to strengthen their immune systems – such that contact with pathogens early in development is actually important to promote health (e.g., Herz, 2012). Others agree that disgust should take years to develop but instead suggest that learning is required to know the unique array of common poisons and pathogen vectors within a particular ecological context; thus, children must develop the expertise to discern which substances in their environment should be avoided and which should be considered food (Cashdan, 1994). Additionally, some researchers posit that sophisticated cognitive capacities may be needed for children to understand the idea of invisible pathogens or toxins at all (Au, Sidle, & Rollins, 1993; Blacker & LoBue, 2016; Kalish, 1998; Rozin & Fallon, 1987; Stevenson, Oaten, Case, Repacholi, & Wagland, 2010). Finally, some suggest that young children do not require disgust, as historically they were exclusively breastfed during the first years of life, and they are often carried around such that caregivers are able to regulate their contact with disease vectors (Curtis & Biran, 2001; Tybur, Lieberman, Kurzban, & DeScioli, 2013). However, the World Health Organization has estimated that pathogen-borne diseases are the most deadly during the first 5 years of life and that communicable illnesses cause over half of deaths in young children across the world (Bryce, Boschi-Pinto, Shibuia, Black, & the WHO Child Health Epidemiology Reference Group, 2005), which would suggest a much earlier need for disgust. Overall, although predictions about the necessity of disgust for avoiding pathogens during infancy and toddlerhood are unclear, it seems that this theory would expect young children to develop disgust soon after weaning, perhaps by 3 years of age (see Rottman, 2014; Rottman, DeJesus, & Gerdin, 2018). It is likely that there would be a gradual tapering of the disgust response as the immune system becomes more robust (and is thus better able to serve as an additional line of defense), although it is unlikely that disgust would ever disappear given the benefits of the "behavioral immune system" (Schaller, 2011; Schaller & Park, 2011).

Disgust as Regulating Social Interactions

Another adaptationist theory of disgust posits that this emotion evolved in part to facilitate social standing – specifically by leading people to avoid interacting with low-status individuals or members of outgroups (Rottman et al., 2018). This theory points to evidence that disgust has the power to create social boundaries and to facilitate aversion toward individuals who fall outside of these boundaries. Food taboos can serve as important markers of group identity (Meyer-Rochow, 2009), as some foods are especially hard to accept among individuals who did not grow up eating them (Peryam, 1963), and even infants and young children associate food choices with cultural groups and form social evaluations on the basis of their food choices (DeJesus, Gerdin, Sullivan, & Kinzler, 2019; Liberman, Woodward, Sullivan, & Kinzler, 2016).

Disgust additionally serves as a highly effective signaling mechanism for indicating social disapproval (Kelly, 2011; Kupfer & Giner-Sorolla, 2017; Tybur et al., 2013). Across cultures and throughout history, beliefs about purity and cleanliness have been used to identify desirable social interaction partners (Speltini & Passini, 2014). Some forms of partner choice and social exclusion may be rooted in basic pathogen avoidance (Faulkner, Schaller, Park, & Duncan, 2004; Kurzban & Leary, 2001; Navarrete & Fessler, 2006). However, recent evidence indicates that White Americans implicitly conceptualize White individuals with significant facial rashes as similar to healthy individuals from a different ethnic group (Petersen, 2017), thus indicating that features signaling poor health and features signaling outgroup membership may be implicitly considered to be functionally equivalent.

Many contemporary scholars acknowledge that many disgust elicitors do not involve pathogen threats (Haidt, Rozin, McCauley, & Imada, 1997) and sometimes include moral violations of norms related to purity and sanctity (Cannon, Schnall, & White, 2011; Rozin, Lowery, Imada, & Haidt, 1999), bodily norms (Russell & Giner-

Sorolla, 2013), and fairness norms (Cannon et al., 2011; Chapman, Kim, Susskind, & Anderson, 2009). Additionally, elevated disgust sensitivity at a trait level is weakly correlated with political conservatism (Inbar, Pizarro, & Bloom, 2009; Inbar, Pizarro, Iyer, & Haidt, 2012) and is moderately correlated with stronger moral condemnation of purity-based moral transgressions (Wagemans, Brandt, & Zeelenberg, 2018). Yet, the involvement of disgust in moral judgment is controversial (see Strohminger & Kumar, 2018). There have been some indications that experimental inductions of disgust amplify moral judgment, even when they are untethered to the issues being evaluated (Schnall, Haidt, Clore, & Jordan, 2008; Wheatley & Haidt, 2005). However, a meta-analysis suggests that these findings are likely false positives (Landy & Goodwin, 2015), and it is probable that induced disgust must be directly linked to the target being evaluated in order to effectively influence moralization (Wisneski & Skitka, 2017). Others have argued that disgust is merely a metaphor when applied to the moral domain and, despite being a common cross-linguistic metaphor, it only applies to sociomoral elicitors in a figurative sense (Royzman & Sabini, 2001). Determining the extent to which moral disgust is merely a proxy for anger will be best accomplished by examining the relative importance of anger and disgust for moral evaluations, particularly when people are judging acts that are not confounded by pathogenic threats. Current evidence is mixed, with some research indicating that feelings of disgust are better predictors of some moral judgments than feelings of anger, even when pathogen cues are not present (e.g., Rottman, Kelemen, & Young, 2014), and other research indicating that anger predominates over disgust even for judgments of nonpathogenic defilement and desecration (e.g., Royzman, Atanasov, Landy, Parks, & Gepty, 2014).

Overall, this theory suggests that disgust *primarily* functions to promote withdrawal from undesirable interaction partners, regardless of whether they are healthy or infected (Rottman et al., 2018). This departs from the more widely accepted pathogen avoidance theory of disgust, which posits that regulating social interactions is a secondary function of disgust, which was co-opted from its primary purpose of precluding pathogen contact (Chapman & Anderson, 2012; Curtis, 2011, 2013; Kelly, 2011; Rozin, Haidt, & Fincher, 2009; Tybur et al., 2013). If social regulation is indeed a primary function of disgust, rather than an incidental by-product, disgust should be predicted to fully develop around the time when children begin to engage in outgroup derogation (as distinct from ingroup favoritism), between 5 and 7 years of age (Aboud, 2003; Buttelmann & Böhm, 2014).

Section Summary: Theories of Disgust

Although the field is moving toward a consensus view that disgust is adaptively suited for preventing contact with pathogens, there remain many competing theories explaining the function of disgust. Some of these theories are multifaceted, suggesting that disgust has had a protracted evolutionary trajectory in humans and possibly earlier primate ancestors, such that it initially evolved from distaste to prevent contact with pathogens, then broadened to additionally hide us from our creatureliness, and finally broadened to promote the condemnation of moral transgressions (Rozin et al., 2016). A similar account that relies more heavily on an adaptationist approach posits that disgust evolved separately to avoid pathogens, to avoid certain kinds of sexual contact, and to avoid moral violations (Tybur et al., 2013). More research on development will bring us closer to determining which of these theories is most compelling. This will in part depend on techniques for accurately assessing whether children and adults are experiencing disgust and, if so, the extent to which their experiences of disgust are conceptually similar. In order to consider how humans experience disgust across the lifespan, we now turn to an examination of existing methods to measure disgust.

Measuring Disgust

Disgust has primarily been studied in adult samples, using a range of different methodologies. In some cases, existing methods reflect the theoretical background and assumptions of the researchers (e.g., basic emotions theorists are more likely to search for distinctive physiological responses), which can powerfully shape the conclusions that are drawn. Because any developmental account is only as good as the available methodologies, and the ability to detect disgust in childhood is greatly impacted by the methods used, here we review the strengths and weaknesses of various measurement techniques for detecting disgust.

Disgust is most commonly measured by self-report, often in the form of questionnaires designed to measure stable individual differences. Participants are typically asked to imagine a variety of potentially revolting experiences (e.g., seeing mold; touching a dead body) and then report whether they would feel disgusted or bothered by each experience. A 32-item Disgust Scale (Haidt, McCauley, & Rozin, 1994), which has been shortened and modified into the 25-item Disgust Scale-Revised (Olatunji et al., 2007), has been widely used in adult samples. This scale measures individual differences in propensities to experience disgust or discomfort toward food, animals, bodily substances, unusual sexual practices, corpses, and contaminants. Representative items include asking participants to express their agreement to items such as "It bothers me to hear someone clear a throat full of mucous" and asking participants to rate their disgust toward scenarios such as "You are about to drink a glass of milk when you smell that it is spoiled." A number of alternative scales exist to assess disgust sensitivity and/or propensity (e.g., Tybur et al., 2009; Van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006).

Although these measures of trait disgust have been widely used in adults, they are only beginning to be adapted for children. Some of these measures are direct variants of adult disgust scales, with minor modifications to items in order to make them more age-appropriate (e.g., Muris et al., 2012). One measure of self-reported disgust in childhood, the Child Disgust Scale (Viar-Paxton et al., 2015), has been developed with items meant to be directly applicable to 5- to 13-year-olds, rather than directly adapting an existing adult measure. This scale asks children to rate their agreement to 14 items (e.g., "If a dog licked my popsicle I would still eat it") that load onto two factors: Disgust Avoidance (measuring children's predicted behavioral responses to disgust elicitors) and Disgust Affect (measuring children's imagined affective responses to disgust elicitors). It has demonstrated acceptable reliability as well as convergent and discriminant validity. Additionally, one study has asked parents to report on their children's disgust responses, which has allowed for some measure of disgust propensities in very young children (Stevenson et al., 2010). Another potential approach is to develop scales that rely less on verbal measures. The Food Disgust Picture Scale is one such attempt to create a disgust-sensitivity scale that uses pictures of foods, rather than verbal descriptions and vignettes (Ammann, Hartmann, & Siegrist, 2018). Though this scale was not developed for children specifically and focuses on food (rather than other disgust elicitors), its use of pictures may provide opportunities to test children and adults from different linguistic and cultural backgrounds using similar measures.

Problematically, most self-report measures do not ensure that they are specifically measuring the experience of disgust, as opposed to general negative affect or other related emotions such as fear or anger. Some studies have also asked children to identify stimuli as disgusting or not disgusting, either by endorsing a label or by judging the appropriateness of a disgust expression (e.g., Danovitch & Bloom, 2009). However, because the number of response options that are made available can impact the nature of such findings (Cameron, Lindquist, & Gray, 2015), it is crucial to allow participants the ability to report a number of other emotional experiences in addition to disgust. Furthermore, self-report measures are generally only possible for children who are sufficiently verbal and who understand the word "disgust," precluding research with infants and toddlers. As such, most research on the development of disgust has not included very young children.

Other research has moved beyond verbal report to focus on behavioral indicators of disgust, which has various strengths including broadening the possible age range of participant samples into infancy. As disgust is associated with rejection and withdrawal, several studies have measured children's willingness to come into contact with a variety of contaminated or otherwise disgusting objects, such as maggots, a dirty sock, and ice cream covered in ketchup (Fallon, Rozin, & Pliner, 1984; Stevenson et al., 2010). In one study, children were directly given these items, and their willingness to touch and interact with the items was coded (Stevenson et al., 2010). Despite the enhanced ecological validity and other advantages of this methodology, avoidance reactions themselves cannot be taken as definitive evidence for the existence of disgust, as a range of other proximate mechanisms can also produce these behaviors (see Rozin & Fallon, 1987). At least in adults, food neophobia (i.e., rejection and behavioral withdrawal from unfamiliar foods) is potentially driven by fear rather than disgust (Raudenbush & Capiola, 2012). Measures of behavioral avoidance may therefore need to be combined with other methodologies to better ensure that researchers are truly measuring disgust.

Because disgust produces a characteristic facial expression (Darwin, 1872/1965; Ekman, Sorenson, & Friesen, 1969; Izard, 1994; but see Reisenzein, Studtmann, & Horstmann, 2013; Russell, 1994; Widen, Pochedly, Pieloch, & Russell, 2013), some researchers have focused on coding people's facial expressions and the movement of their facial muscles to assess the presence or absence of disgust. The expression that is typically described as the "disgust face" is primarily produced by the operation of the levator labii muscle, which is active when a person raises her upper lip and wrinkles her nose. This facial expression can be detected by the naked eye and categorized as indicating disgust through the Facial Action Coding System (Ekman & Friesen, 1976), and facial coding has been successfully used with children (e.g., Stevenson et al., 2010) and newborn infants (Rosenstein & Oster, 1988). A more objective method for detecting and measuring activity of the levator labii is through facial electromyography (EMG), which has been reliably used in adults (e.g., Cannon et al., 2011; Chapman et al., 2009; Shenhav & Mendes, 2014), but has not been attempted in child samples to our knowledge.

However, coding of infants', children's, and adults' facial expressions as indicating disgust is often unreliable (Izard, Huebner, Risser, & Dougherty, 1980; Lewis, Sullivan, & Vasen, 1987). Some evidence suggests that the physiological indicators of disgust measured by EMG may not reliably correlate with subjective feelings of disgust (Stark, Walter, Schienle, & Vaitl, 2005), and accurately categorizing the disgust face is heavily dependent on contextual cues (Aviezer et al., 2008). Additionally, because the disgust expression is often used as a signaling mechanism, communicative motives can determine the extent to which it is displayed (Kupfer & Giner-Sorolla, 2017). Certain social settings facilitate signaling feelings of disgust, such that the facial expression is produced more strongly in social settings than in private (Jäncke & Kaufmann, 1994). In one study in which undergraduates were asked to smell urine and rancid sweat, and were covertly filmed while they were otherwise alone in a room, naïve coders were unable to accurately code participants' facial expressions as indicating disgust (Gilbert, Fridlund, & Sabini, 1987). Conversely, in social settings where signaling disgust would violate social norms or be considered impolite, children and adults have been found to successfully suppress or mask their facial expressions of disgust (Soussignan & Schaal, 1996). Because the disgust face is not reflexively produced upon experiencing disgust but is rather heavily influenced by the social context – as may be the case for facial expressions more generally (Crivelli & Fridlund, 2018) – third-party observation of the disgust face may be an inconsistent means of reliably measuring disgust (also see Barrett, 2017).

Neuroimaging methods have also been utilized to detect disgust. Functional Resonance Magnetic Imaging (fMRI) studies have typically indicated that disgust is associated with increased

activity in the anterior insula (e.g., Jabbi, Bastiaansen, & Keysers, 2008; Vytal & Hamann, 2010). However, this does not indicate that insular activity is either necessary or sufficient for producing an experience of disgust. This brain region is also active when viewing facial expressions of disgust, suggesting that it may be involved in other components of disgust processing beyond the immediate visceral experience (Phillips et al., 1997). Furthermore, there are other emotional states such as fear that elevate insular activation, and there are other brain regions outside the insula that are activated when experiencing disgust (Schaich Borg, Lieberman, & Kiehl, 2008; Schienle et al., 2002). Indeed, there is unlikely to be such a simple mapping of localized neural activation to the experience of disgust (Chapman & Anderson, 2012; Lindquist et al., 2012). Additionally, this methodology does not lend itself well to developmental research and has not been used to measure disgust in children. Similarly, electrogastrography (EGG), which involves recording gastric muscle contractions by placing electrodes on the abdomen, has been successfully used to measure biological markers of disgust in adults (Meissner, Muth, & Herbert, 2011; Shenhav & Mendes, 2014) but, to our knowledge, has never been used as a measure of disgust in infants or children.

While feelings of disgust are often measured as a dependent variable, several studies have attempted to elicit disgust as an independent variable in order to examine its effect on other phenomena. Compared to other emotions, disgust is both easy and ethical to elicit artificially, and it has been experimentally produced by stimuli ranging from film clips to fart spray (e.g., Schnall et al., 2008). This body of research has focused almost exclusively on adults, although a handful of studies have involved child participants (Rottman & Kelemen, 2012; Rottman, Young, & Kelemen, 2017), and it is reasonable to expect that these methods would be possible even for infants.

Section Summary: Measuring Disgust

Although disgust is most commonly measured with self-report, this presents difficulties for studying very young children and preverbal infants. Additionally, because many scales for measuring disgust sensitivity in childhood are directly adapted from adult research, without consideration of whether disgust manifests differently across the lifespan or whether the nature of disgust elicitors is different in childhood and adulthood, retaining validity may be problematic (Viar-Paxton et al., 2015). To date, measurements of disgust in infancy and toddlerhood have been limited to analyzing facial expressions (Rosenstein & Oster, 1988), avoidance behavior (Stevenson et al., 2010), and responses to the facial expressions of others (Ruba, Johnson, Harris, & Wilbourn, 2017).

Overall, there is no gold standard for measuring the experience of disgust. Every methodology carries inherent flaws, and different methodologies will tend to produce different conclusions about the prevalence of the disgust response across situations and even different conclusions about the human uniqueness of disgust. Thus, convergent evidence from varied research designs is important for making strong conclusions about the emergence of disgust during childhood.

Disgust Across the Lifespan

Research on the ontogeny of disgust remains in its infancy. A majority of research on disgust has focused on adults, with only a small body of literature examining its initial emergence (see Rottman, 2014). Even less research has been conducted on how disgust changes across age, particularly during adolescence and old age (see Sawchuk, 2009). The present section reviews research that has been conducted with infants, toddlers, and young children and explains how a developmental perspective can expand our understanding of this emotion.

The Nature and Nurture of Disgust

Disgust is simultaneously universal and culturally diverse. Some components of disgust appear to be canalized and invariant across diverse environments, while other components appear to be highly variable and require protracted learning. Certain disgust elicitors, such as feces and urine, are often said to be widespread, existing in perhaps all human societies (Angyal, 1941; Curtis, 2013; Curtis et al., 2011). However, anthropological and archeological evidence indicates that there are exceptions; for example, there are ethnographic accounts of Inuit people bathing in urine and Hazda people casually gathering baobab seeds from baboon feces to prepare for meals (see Speth, 2017). Indeed, many disgust elicitors that are often assumed to be widespread may in fact be primarily constrained to modern Europeans and Americans. Although rotting flesh is thought to be a universal disgust elicitor (Curtis, 2013), deliberately putrefied meat was likely perceived as desirable rather than disgusting by most human societies throughout history, including many modern hunter and gatherer societies in the arctic and subarctic (Speth, 2017). In addition, there is a great diversity in many other disgust elicitors, as exemplified by the wide range of food taboos seen across societies (Harris, 1985; Meyer-Rochow, 2009). There are many examples of substances that are celebrated as delicacies in some cultures but that are considered taboo (e.g., beef, pork) and/or disgusting to consume (e.g., pungent blue cheese, nattō, tripe) in other cultures. Some research has indicated that foods which are likely to harbor bacteria or toxins are particularly likely to be tabooed (Fessler & Navarrete, 2003; Henrich & Henrich, 2010), supporting the disease avoidance theory of disgust and again pointing toward the possibility of underlying universals in disgust elicitors.

Focus group discussions and interviews with adult respondents from three continents suggest that most disgust elicitors can be categorized as bodily substances, rot/decay, animals, other people, or moral violations (Curtis & Biran, 2001). Interviews with American children suggest that this is not constant across development; in particular, a large proportion of children identify fresh vegetables as being disgusting (DeJesus, Rottman, & Gerdin, unpublished data). Overall, even though disgust reliably emerges around the world, it seems to be largely the product of enculturation. However, the extent to which this learning is innately constrained is currently unknown, as are the specific causes of the development of disgust.

Overview of Developmental Trajectory

Aversions to malodorous and bitter stimuli are evident in newborns (Soussignan, Schaal, Marlier, & Jiang, 1997), but few would classify these basic responses as constituting disgust given that they are confined to direct sensory stimulation and operate reflexively (Rozin et al., 2016; but see Sawchuk, 2009). Despite these early-emerging aversions, it seems that full-fledged disgust develops considerably later than all other basic emotions. While some studies have found evidence that children as young as 2.5 years avoid some disgust elicitors (e.g., Stevenson et al., 2010), most research has identified the emergence of disgust as occurring years beyond this, perhaps around the age of 5 (see Rottman, 2014; Rozin et al., 2016; Rozin & Fallon, 1987).

In the most comprehensive study of the development of disgust to date, Stevenson and colleagues (2010) mapped the developmental trajectory of children's reaction to a variety of disgust elicitors, including "core" (i.e., bodily or pathogenic) elicitors (e.g., a dirty sock, the odors of fertilizer and fermented shrimp paste), animal elicitors (e.g., maggots, touching a glass eye), and sociomoral elicitors (e.g., stealing from a person with a disability, and the marriage between a man and a much older woman). Children ranging in the age from 2 to 10 were presented with these disgust elicitors, and their behaviors (e.g., willingness to touch the item) and facial reactions (e.g., expression of the disgust face) were recorded. A convergence of multiple methods found that children began to exhibit disgust toward bodily fluids and rotten foods around 2.5 years of age, followed by disgust toward animals and

animal products by 4.5 years of age, and disgust toward sociomoral elicitors by 7 years of age. This study highlights the possibility that a conceptual understanding of disgust evolves over childhood and may be unnecessary for early emerging disgust reactions. Although the capacity for sociomoral evaluation has been documented in infancy (Hamlin, Wynn, & Bloom, 2007; Steckler et al., 2018; Van de Vondervoort & Hamlin, 2018), it appears that the connection between sociomoral judgments and disgust unfolds over a lengthy developmental period.

Development of Distaste and Avoidance

From the perspective of disgust as a food-related emotion (Rozin & Fallon, 1987), distaste is an important and early emerging precursor to a fuller understanding of disgust. As soon as the infant diet begins to expand beyond exclusively milk and formula, infants express distaste for some foods (Birch, 1990, 1999; Ventura & Mennella, 2011). A dislike for bitter flavors, and subsequent rejection of bitter foods, is observed in human infants and a variety of species, including nonhuman primates and rats (Grill & Norgren, 1978; Mennella, Pepino, & Reed, 2005; Steiner, Glaser, Hawilo, & Berridge, 2001). This early and widespread rejection response is thought to have evolved to prevent the ingestion of toxic substances, many of which are characterized by bitter flavors and are carried by plants (Keeler & Tu, 1991; Reed & Knaapila, 2010). In line with this theory, infants demonstrate an early tendency to avoid touching plants and selectively learn about the edibility of plants from other people (Wertz & Wynn, 2014a, 2014b; but see Kochanska, Tjebkes, & Forman, 1998). Infants and young children also view disliked food as a potential contaminant – in two related studies, 18- to 26-month-old and 4- to 6-year-old children rejected foods that they otherwise typically enjoyed if that food came into contact with foods that they disliked (Brown & Harris, 2012; Brown, Harris, Bell, & Lines, 2012). Moreover, children and adults avoid foods that they associate with illness, even if they can identify a different cause of those sick feelings, such as chemotherapy (Bernstein, 1978, 1994).

Despite these early emerging tendencies to avoid dangerous or toxic items and to extract social meaning from demonstrations of liking and disliking foods (e.g., Liberman et al., 2016), infants and very young children demonstrate a surprising willingness to make food choices that older children and adults would not make. Retrospective parental reports suggest that children younger than 2 years of age are particularly cavalier in their receptivity to eating novel substances (Cashdan, 1994). Although food neophobia and picky eating behaviors tend to peak shortly thereafter (see Lafraire, Rioux, Giboreau, & Picard, 2016), young children remain willing to consume some substances that are generally considered disgusting by adults, as has been demonstrated by several classic studies. When children between the ages of 3 and 12 were presented with hypothetical vignettes, children rejected foods based on distaste earliest, and only later rejected foods on the basis of potential for harm (e.g., a poisoned beverage) or potential contamination (e.g., a beverage containing an insect or feces). Younger children also required fewer steps to consider contamination to have been abated. For example, they expressed willingness to drink a glass of milk immediately after a grasshopper was removed from the glass, rather than requiring the glass to be thoroughly washed (Fallon et al., 1984). Similar results indicating young children's willingness to consume potentially dangerous or contaminating items have been found when children were presented with real items (e.g., Rozin, Fallon, & Augustoni-Ziskind, 1985). In one study, a majority of toddlers (ranging from 16 to 29 months of age) were found to be surprisingly willing to put disgusting or dangerous items in their mouths, such as imitation feces (crafted from peanut butter and limburger cheese) and imitation dish soap (Rozin, Hammer, Oster, Horowitz, & Marmora, 1986). This evidence has been taken to suggest that development in the food domain has a protracted timeline and consists of learning what is *not* edible (Rozin, 1990; but see Bloom, 2004).

Development of Contamination Beliefs

Understanding contamination is particularly important from the perspective that disgust functions to avoid pathogens (Curtis, 2013; Oaten et al., 2009). However, avoiding disease vectors, either from contaminated foods or sick people, appears to take several years of life to develop. Some evidence of contamination sensitivity has been observed around preschool age (Raman & Gelman, 2008; Siegal, Fadda, & Overton, 2011; Siegal & Share, 1990; Toyama, 2016), and even infants view disliked foods as contaminants (Brown & Harris, 2012). However, other studies have indicated that this competence is not fully developed until later in childhood, perhaps because young children tend to have difficulties understanding mechanisms of contamination and illness (Fallon et al., 1984; Legare, Wellman, & Gelman, 2009; Solomon & Cassimatis, 1999). In one study that examined children's sensitivity to contamination across childhood, participants were offered one food that appeared to be clean and one food that appeared to be contaminated by a sick person's germs. In this study, 5- to 8-year-old children ate more of the clean food and rated the clean food as tasting better than the contaminated food, while 3- to 4-year-old children did not differentiate between the two foods (DeJesus, Shutts, & Kinzler, 2015). Similarly, another study found that 6- and 7-year-old children avoided contact with sick adults, whereas 4- and 5-year-old children did not (Blacker & LoBue, 2016). The ability to make predictions about illness was a better predictor of children's avoidance behavior than age, suggesting that conceptual knowledge about illness serves as a catalyst for contamination avoidance.

Despite what are often considered to be evolved mechanisms to prevent young humans from consuming dangerous items and to promote "defensive eating" (Reed & Knaapila, 2010), the developmental evidence suggests that avoiding disgusting or contaminated items unfolds over a protracted period of time. This may be because an understanding of contamination is supported by the emergence of abstract cognitive abilities, such as the ability to think about causal entities like bacteria that are not visible to the naked eye (Rozin et al., 1985). Although disgust may exist independently of an explicit understanding of contamination (Stevenson et al., 2010), folk biological knowledge of contaminants certainly contributes to a mature competence.

Enculturation of Disgust

Beyond the innate avoidance of bitter flavors, which is generally described as evidence of distaste rather than disgust and which is largely transmitted through genes such as TAS2R38 (Mennella et al., 2005; see Reed & Knaapila, 2010), much of what is avoided for being disgusting is heavily contingent upon cultural learning (see Feder, 2015). Children's food preferences are largely shaped through social influences such as modeling (see Birch, 1999; Shutts, Kinzler, & DeJesus, 2013), and even infants are attuned to the food choices that are made by ingroup rather than outgroup members (Shutts, Kinzler, McKee, & Spelke, 2009). Parent-child interactions are important sources of information about disgust (Stevenson et al., 2010), and children often look to adults to learn disgust toward specific objects or entities (Askew, Çakır, Põldsam, & Reynolds, 2014). Although chili peppers and other piquant foods are rejected by many other species (e.g., Galef, 1989), human children can be enculturated by the food practices of their community and learn to enjoy the flavor of spicy food (Rozin & Schiller, 1980). Beliefs about contamination and explanations for illness also vary across cultures (Hejmadi, Rozin, & Siegal, 2004; Legare, Evans, Rosengren, & Harris, 2012; Legare & Gelman, 2008, 2009), as does the production of disgust responses (Camras, Bakeman, Chen, Norris, & Cain, 2006).

Most theorists have assumed that children use caregivers' emotional expressions of disgust to learn about what is disgusting. However, this is unlikely to be an effective mechanism given children's difficulty in identifying the disgust expression (see Widen & Russell, 2013). Although even 10- and 18-month-olds are capable of perceptu-

ally distinguishing disgusted faces from angry faces, as measured by the amount of time that infants look at different faces (Ruba et al., 2017), it is not clear that these infants recognize the disgust face *qua* disgust, particularly as other evidence indicates that it takes many years for children to fully appreciate the meaning of the facial expression of disgust (Widen & Russell, 2013). Children are generally unable to specifically identify the disgust face as expressing disgust before the age of 9 (Widen & Russell, 2008), typically labeling it as instead expressing anger (Gagnon, Gosselin, Hudon-ven Der Buhs, Larocque, & Milliard, 2010; Mancini, Agnoli, Baldaro, Ricci Bitti, & Surcinelli, 2013; Widen & Naab, 2012). This stands in stark contrast to children's ability to recognize other basic emotional expressions (e.g., happiness, fear), which are recognized early and with stability across childhood (Camras & Allison, 1985; Rodger, Vizioli, Ouyang, & Caldara, 2015).

Although parents' vocalizations of disgust (e.g., "yuck!"), in combination with gestures conveying avoidance, are associated with their children's tendencies to display disgust responses (Oaten, Stevenson, Wagland, Case, & Repacholi, 2014), young children also do not appear to be prepared to associate vocalizations of disgust with prototypical disgust elicitors. Rather, 3-year-olds are equally likely to orient to rotten foods and to snakes when hearing adults express disgust (Stevenson, Oaten, Case, & Repacholi, 2014), suggesting that children may interpret these vocalizations as indicative of fear or general negativity, rather than as specifically indicating disgust. However, emotive demonstrations of disgust may reveal important commonalities between parents and their children; parents of young children were more emotive when presented with disgust elicitors alongside their children, and children's disgust reactions were correlated with their parent's reactions (Stevenson et al., 2010).

Given the ambiguity of nonverbal cues toward disgust, it is possible that children rely heavily upon linguistic cues when learning what is disgusting. Children are highly susceptible to adults' verbal testimony when determining what to eat (Lumeng, Cardinal, Jankowski, Kaciroti, & Gelman, 2008), and testimony about the disgustingness of various stimuli has been shown to be more effective than nonverbal cues in socializing disgust in 8- to 12-year-old children (Muris et al., 2013). Children also readily learn novel moral proscriptions from adults' testimony that harmless actions are disgusting and gross (Rottman et al., 2017).

Beyond shaping first-person preferences, humans glean third-person social information from the food rejections of other people from an early age. Infants expect food preferences to align with patterns of social affiliation. After watching videos of two people who either shared food preferences (both demonstrated positive affect towards the same food) or had inverse preferences (one person demonstrated positive affect toward a food and the other person demonstrated negative affect toward that food), 9-month-old infants expected people who shared food preferences to affiliate with each other and people who did not share food preferences to turn away from each other (Liberman, Kinzler, & Woodward, 2014). Babies also draw the reverse inference; one study found that 14-month-old infants expected people who affiliated with each other or spoke the same language to share food preferences, but did not expect people who did not affiliate with each other or spoke in different languages to share food preferences (Liberman et al., 2016). In a series of studies with 5-year-old children, children expected cultural ingroup members (i.e., individuals who spoke the child's native language) to eat common food combinations (e.g., hot dogs with mustard, milk with chocolate syrup) and cultural outgroup members to eat uncommon combinations of common foods (e.g., milk with mustard, hot dogs with chocolate syrup), rather than the reverse pattern. However, children's own ideas about what is commonly eaten in their culture influenced their judgments of other people; they negatively judged individuals who ate unconventional foods, nonfoods, and disgust elicitors, even when those individuals were from a different cultural group (DeJesus et al.,

2019). These studies provide evidence that, regardless of their ability to understand or express disgust, infants and young children already demonstrate remarkable capabilities to make inferences about the relationship between food and social structures, which may provide an important foundation for the enculturation of disgust in early development.

Theoretical Implications of Developmental Evidence

The delayed and protracted emergence of disgust can help to mediate between different theoretical explanations of the ultimate origins of disgust (Rottman, 2014). As reviewed previously, several theoretical accounts of disgust would strongly predict its emergence by the time children enter preschool. This is perhaps most notably true for the pathogen avoidance theory of the evolution of disgust. Given that disgust may emerge too late in development to be effective in meeting the acute need for evading pathogens and thus reducing the burdens of the underdeveloped immune system, it is possible that a full explanation of disgust may require moving beyond claims that it exclusively functions for evading disease (Haidt et al., 1997; Rottman, 2014; Rozin et al., 2016). For example, if disgust is at least partially adapted for regulating social interactions, its late emergence is more easily explained given the developmentally later need for maintaining social status (Rottman et al., 2018). In addition, evidence that disgust does not come online as a single package, but rather seems to emerge along distinct developmental trajectories for different types of elicitors (Stevenson et al., 2010), provides developmental support to theories that there are multiple instantiations of disgust (e.g., core disgust, moral disgust) serving different adaptive functions (Tybur et al., 2013). However, these claims must remain tentative until additional research more definitively maps out the developmental emergence of disgust. It is certainly possible that creative new methodologies will uncover indications that disgust is acquired much earlier than current measurements are able to detect.

Section Summary: Disgust Across the Lifespan

The examination of disgust's developmental trajectory reveals both common, early expressions of disgust and aspects of this emotion that are revised across development and influenced by cultural backgrounds. These studies have primarily focused on children's eating behaviors and their avoidance of core disgust elicitors and sick individuals, and they do not investigate reactions to sexual behavior or violations of moral purity, given the inappropriateness of these topics and gaps in young children's knowledge base. However, this constrained focus raises broader questions as to whether disgust is experienced or understood differently by children and adults.

Although current evidence suggests that disgust is largely the product of sociocultural learning, other causal mechanisms are in need of investigation. Additionally, beyond further research on acquisition processes, it may be equally critical to examine how disgust can be extinguished – as it may be necessary to override feelings of disgust to successfully accomplish important goals such as caring for the sick or cleaning up garbage. Some work exists on habituation in adults, indicating that frequent exposure to disgust elicitors reduces the concomitant disgust response, particularly in mothers (Case, Repacholi, & Stevenson, 2006; Prokop & Fančovičová, 2016) and medical practitioners (Rozin, 2008; van Dongen, 2001). However, these processes have not yet been examined across child development.

Broader Implications

Most scholarly work on disgust can be classified as basic research on the nature, development, and elicitors of disgust. However, it is also critical to understand the potential applications of disgust research. In the present section, we discuss the

clinical and health-related implications of disgust, as well as its relevance for larger societal issues. We encourage researchers to take careful note of these domains of inquiry, as we believe that understanding the relevance of disgust for applied interventions could serve to meaningfully impact both the research literature and the wellbeing of clinical, underserved, and stigmatized populations.

Disgust and Disorders

Abnormal disgust sensitivity is characteristic of several neurological, developmental, and psychopathological disorders (see Olatunji & McKay, 2009). Elevated levels of disgust toward typical disgust elicitors may both cause and sustain symptoms of phobias and other anxiety-related disorders, as well as other disorders ranging from obsessive-compulsive disorder (OCD) to eating disorders (Davey, 2011; Muris, van der Heiden, & Rassin, 2008; Phillips, Senior, Fahy, & David, 1998). Heightened levels of disgust directed toward the self can also manifest in a range of psychiatric disorders, including body dysmorphic disorder (Neziroglu, Hickey, & McKay, 2010). In contrast, impaired or absent levels of disgust have been found in individuals diagnosed with Huntington's disease (Hayes, Stevenson, & Coltheart, 2007; Mitchell, Heims, Neville, & Rickards, 2005) and autism spectrum disorder (Kalyva, Pellizzoni, Tavano, Iannello, & Siegal, 2010). Some clinicians have successfully targeted disgust in therapeutic treatments for specific phobias (de Jong, Andrea, & Muris, 1997; Oar, Farrell, & Ollendick, 2015), suggesting an important potential for intervention in disgust-related research.

Although anxiety disorders and phobias are often discussed in relation to abnormally high levels of fear, they can also result from abnormally high levels of disgust. This is likely because heightened fear and heightened disgust are often tightly coupled. Spider phobia is associated with feeling greater disgust toward spiders (Sawchuk, Lohr, Westendorf, Meunier, & Tolin, 2002; Vernon & Berenbaum, 2002), beliefs that spiders are contaminating (de Jong & Merckelbach, 1998), and displaying both fearful and disgusted facial expressions in the presence of spiders (Vernon & Berenbaum, 2002). Similarly, blood-injection-injury (BII) phobia is associated with heightened trait disgust (de Jong & Merckelbach, 1998), increased contamination fears (Olatunji, Lohr, Sawchuk, & Patten, 2007), self-reported feelings of disgust in the presence of BII-related stimuli (Sawchuk et al., 2002; Tolin, Lohr, Sawchuk, & Lee, 1997), and increased facial expressions of disgust when watching videos of surgical incisions (Lumley & Melamed, 1992), as well as fainting due to the decreases in blood pressure and heart rate that are produced by disgust (Page, 2003). As specific phobias typically have an early onset (Oar et al., 2015), it is likely that this coupling of fear and disgust in the presence of certain animals or bodily injuries occurs in childhood. Indeed, conditioning 9–13-year-olds to experience disgust toward a novel animal also leads them to become more prone to fear the animal (Muris, Huijding, Mayer, & de Vries, 2012; Muris, Mayer, Huijding, & Konings, 2008). Similarly, the patterning of disgust implicated in anxiety disorders is found in both children and adults (Moretz, Rogove, & McKay, 2011).

Increased levels of disgust are also associated with OCD (Deacon & Olatunji, 2007; Muris et al., 2000; Tsao & McKay, 2004), and disgust often serves as a driving force for the compulsive avoidance of potential contaminants (Moretz & McKay, 2008; Thorpe, Patel, & Simonds, 2003). Disgust may also underlie the frequent and routinized washing and compulsive cleaning behaviors that are common in OCD (Brady, Adams, & Lohr, 2010; Foa & Kozak, 1995). People with contamination-related OCD symptoms also have strengthened beliefs that once an object has been contaminated, the object will always be contaminated (Tolin, Worhunsky, & Maltby, 2004). Elevated disgust sensitivity is correlated with OCD symptoms in both preadolescents and adults (Olatunji, Williams, Lohr, & Sawchuk, 2005).

Unsurprisingly, given its theorized role as a guardian of the mouth (Rozin & Fallon, 1987), heightened disgust may be implicated in eating disorders such as anorexia and bulimia (Davey, Buckland, Tantow, & Dallos, 1998), which is

perhaps exacerbated by the disgust reactions that are experienced toward overweight individuals (Harvey, Troop, Treasure, & Murphy, 2002). Disgust sensitivity can also predict picky eating (Kauer, Pelchat, Rozin, & Zickgraf, 2015), which, in extreme cases, can become clinically diagnosed as an avoidant restrictive food intake disorder (Zickgraf, Franklin, & Rozin, 2016).

Although clinicians will generally need to focus on techniques for attenuating disgust when treating phobias, OCD, and eating disorders, there are some cases in which therapeutic treatments may call for elevating levels of disgust. As was evocatively suggested in Burgess' *A Clockwork Orange,* disgust elicitors can be powerful unconditioned stimuli in aversion therapy. Similar techniques have been used for the treatment of people with alcohol dependence and sex offenders, indicating that capitalizing upon the disgust response – for example, by pairing photos of vomit with alcohol – may be a potent clinical tool for shaping behavior (see McKay & Tsao, 2005). In general, future research should investigate the various ways in which disgust can be leveraged to alleviate clinical disorders.

Disgust, Nutrition, and Health

Research on disgust is not only broadly applicable for clinicians treating psychopathologies but also carries more widespread relevance in the context of everyday nutrition and health, as well as for facilitating more ecologically sustainable eating practices. The United Nations Food and Agriculture Organization recently published a report advocating for the consumption of insects as a sustainable solution for obtaining protein, with both environmental and nutritional benefits (van Huis et al., 2013). However, feelings of disgust toward eating insects, particularly in Western cultures, are an important barrier to this effort (Ruby, Rozin, & Chan, 2015). As such, the incorporation of insects into the Western diet will at least initially require the insect protein to be unseen to avoid reminding consumers that they are eating insects (Gere, Székely, Kovács, Kókai, & Sipos, 2017; Hartmann, Shi, Giusto, & Siegrist, 2015; Megido et al., 2016). Eating insects is merely one of many ways in which common disgust responses can serve as a barrier to promoting physical and ecological health.

Scales developed to study disgust in children and adults (e.g., Haidt et al., 1994; Viar-Paxton et al., 2015) sometimes include food items, but these items are generally restricted to visibly rotten or contaminated foods or unusual food combinations, rather than healthy foods that children tend to reject (e.g., vegetables) or foods that carry pathogens or toxins but look perfectly safe to eat (e.g., romaine lettuce contaminated by *E. coli* or water contaminated by lead). Other researchers from a range of disciplines have studied the development of food preferences and picky eating, yet disgust is rarely studied directly in these investigations. For instance, the Child Eating Behavior Questionnaire, a validated and widely used questionnaire in studies of children's eating behavior (Wardle, Guthrie, Sanderson, & Rapoport, 2001), includes a Food Fussiness subscale that includes the rejection of foods on ideational grounds (e.g., "my child decides that s/he does not like a food, even without tasting it"), but few studies administer this questionnaire when considering children's experiences of disgust. This gap in knowledge regarding the relation between disgust, food intake, and health outcomes suggests an important opportunity for interdisciplinary collaboration.

In addition to potential links between disgust and eating behavior, studying disgust in the context of obesity stigma presents another potential link between disgust and health. Consistent with the studies described previously in the context of disgust as reifying social boundaries, there is considerable stigma surrounding obesity (Carr & Friedman, 2005; Puhl & Brownell, 2001; Puhl & Heuer, 2010; Schwartz, Chambliss, Brownell, Blair, & Billington, 2003; Strauss & Pollack, 2003) and people who are overweight are sometimes described as "disgusting" (Sandberg, 2007), potentially because obesity is implicitly associated with disease threats (Park et al., 2007). Not only do these patterns have implications for individuals' daily quality of life and well-being, but obesity stigma has also been shown to have negative implications for the quality of care people receive from healthcare providers and the

attitudes and stereotypes healthcare providers hold toward their patients (Malterud & Ulriksen, 2011; Phelan et al., 2015). Given that important links have been observed between psychosocial stress and weight gain (Knutson, Spiegel, Penev, & van Cauter, 2007; Lumeng et al., 2014), understanding the role of disgust in obesity stigma may have important consequences for individuals' health outcomes and interactions with healthcare providers.

Public Health Interventions

Disgust may provide humans and other species with a psychological mechanism that facilitates the behavioral avoidance of infectious substances, thus serving as a proactive defense that reduces burdens on the immune system for protecting against disease (Curtis & Biran, 2001; Schaller, 2011). Tragically, however, pathogen-borne diseases remain one of the primary causes of mortality worldwide, especially for children (Bryce et al., 2005). This suggests that, even if disgust does ward off some illnesses, it is not heavily effective in naturally preventing contact with many dangerous disease vectors. The ineffectiveness of disgust in avoiding pathogens in modern environments constitutes a crucial public health concern in which top-down interventions are needed to reduce engagement in many unhygienic behaviors. Could disgust, particularly in social contexts, be fruitfully leveraged as a tool in these interventions?

Historically, cleaning practices have been performed for purposes of spiritual purification rather than hygienic purposes. Therefore, norms of proper cleaning do not always effectively reduce the spread of germs. While most people in modern, industrialized societies stigmatize individuals with poor hygiene (Oaten et al., 2011), this has not always been the case. Indeed, there have been times when washing has been considered to produce spiritual *un*cleanliness, as touching oneself was considered impure according to Christian doctrine (Speltini & Passini, 2014). This symbolic, rather than health-related, understanding of cleanliness has presented difficulties for introducing hygienic practices into societies that do not engage in them.

Poor sanitation in heavily populated areas presents a significant public health risk for much of the world's population. Entraining disgust responses to public defecation could present a low-cost solution to encouraging more people to utilize toilets when they are available. Indeed, some research has indicated that disgust can be an important mechanism for introducing social disapproval of poor hygiene. A sanitation and hygiene intervention in Nepal, which centrally involved disgust along with habit formation, reshaped local norms relating to hygienic handwashing practices (McMichael & Robinson, 2016). Other successful interventions have similarly promoted disgust at evidence that washing without soap can leave residues of fecal matter on one's hands upon wiping oneself after defecating (Curtis, Danquah, & Aunger, 2009).

Social Justice

Characterizing outgroup members, social deviants, or enemies as "dirty" or "disgusting" is a common political tactic. This technique for marginalization and stigmatization has perpetuated atrocities throughout history, spanning from ancient Chinese, Egyptian, and Mesopotamian cultures through Nazi propaganda and into modern political discourse – and it seems to succeed in shaping perceptions of outgroup members as being less than human (Harris & Fiske, 2006; Hodson & Costello, 2007; also see Nussbaum, 2004; Smith, 2011). The extent to which people feel disgust toward outgroup members is reliably associated with prejudice toward marginalized groups, and this correlation remains intact even when statistically controlling for perceived vulnerability to pathogen-borne illnesses (Hodson et al., 2013). Disgust is felt toward individuals who are deemed to have bad moral character that causes them to be socially deviant (Giner-Sorolla & Chapman, 2017), toward individuals and ideas that are considered contaminating to one's ingroup (Cottrell & Neuberg, 2005), and, more generally, toward anybody who is not obviously a member of one's ingroup (Reicher, Templeton, Neville, Ferrari, & Drury, 2016). Thus, attempting to mitigate disgust responses in sociopolitical arenas could serve as a crucial tactic for promoting equity and basic human rights. As social biases against people who are unclean are intact by the age of five

(Rottman et al., 2019), it may be prudent for these interventions to focus on young children. Uncovering effective solutions for reducing disgust-fueled forms of prejudice and discrimination presents a ripe area for further research.

Section Summary: Broader Implications

Research increasingly indicates that disgust is critically associated with various psychopathologies, has profound implications for healthy eating, and could even carry the potential to save the lives of millions worldwide. While disgust may serve as a useful tool for increasing health benefits, particularly in leading to improved hygiene, it is also a double-edged sword (see Curtis, 2013). Individuals who lack access to sanitation, who are chronically sick, who are overweight or obese, or who have morphological abnormalities often trigger feelings of disgust in others, which tends to increase shame and ostracism. When experienced in excess, disgust can carry many negative consequences. Researchers and practitioners must take care in attempting to either attenuate or amplify disgust responses, and the costs and benefits of each should be a major focus of future research on the development of disgust. In addition, understanding how to intervene on disgust in a targeted way, rather than universally increasing or reducing disgust responses, is a particularly critical direction for future research, given that disgust may differentially impact various social judgments and health outcomes. For instance, it might be helpful to reduce disgust reactions to eating insects specifically (in order to promote the consumption of a sustainable protein), while preserving disgust toward bodily products (in order to promote bathroom handwashing).

Conclusion

Emotion researchers have often pooh-poohed disgust, choosing to focus their studies instead on sadness, anger, fear, and various other emotions. Here, we have provided evidence that disgust is in fact a central component of human nature. Despite its protracted developmental trajectory and highly variable set of elicitors, disgust seems to reliably develop across cultures, thus comprising a human universal. Disgust may be among the most relevant psychological capacities for improving public health, given its central role in avoiding one of the top killers of humankind: pathogen-borne diseases. Conversely, disgust has dark implications for social justice, as it breeds dehumanization and bigotry. A better understanding of whether disgust should be championed or maligned will be deeply informed by developmental investigations of the emergence and unfolding of disgust in childhood.

References

Aboud, F. E. (2003). The formation of in-group favoritism and out-group prejudice in young children: Are they distinct attitudes? *Developmental Psychology, 39*(1), 48–60.

Ammann, J., Hartmann, C., & Siegrist, M. (2018). Development and validation of the Food Disgust Picture Scale. *Appetite, 125*, 367–379.

Angyal, A. (1941). Disgust and related aversions. *Journal of Abnormal and Social Psychology, 36*, 393–412.

Askew, C., Çakır, K., Põldsam, L., & Reynolds, G. (2014). The effect of disgust and fear modeling on children's disgust and fear for animals. *Journal of Abnormal Psychology, 123*(3), 566–577.

Au, T. K., Sidle, A. L., & Rollins, K. B. (1993). Developing an intuitive understanding of conservation and contamination: Invisible particles as a plausible mechanism. *Developmental Psychology, 29*(2), 286–299.

Aviezer, H., Hassin, R. R., Ryan, J., Grady, C., Susskind, J., Anderson, A., … Bentin, S. (2008). Angry, disgusted, or afraid? Studies on the malleability of emotion perception. *Psychological Science, 19*(7), 724–732.

Barrett, L. F. (2017). *How emotions are made: The secret life of the brain*. New York, NY: Houghton Mifflin Harcourt.

Becker, E. (1973). *The denial of death*. New York, NY: Free Press.

Bernstein, I. L. (1978). Learned taste aversions in children receiving chemotherapy. *Science, 200*, 1302–1303.

Bernstein, I. L. (1994). Development of food aversions during illness. *Proceedings of the Nutrition Society, 53*, 131–137.

Birch, L. L. (1990). Development of food acceptance patterns. *Developmental Psychology, 26*(4), 515–519.

Birch, L. L. (1999). Development of food preferences. *Annual Review of Nutrition, 19*(1), 41–62.

Blacker, K.-A., & LoBue, V. (2016). Behavioral avoidance of contagion in childhood. *Journal of Experimental Child Psychology, 143*, 162–170.

Bloom, P. (2004). *Descartes' baby: How the science of child development explains what makes us human*. New York, NY: Basic Books.

Brady, R. E., Adams, T. G., & Lohr, J. M. (2010). Disgust in contamination-based obsessive-compulsive disorder: A review and model. *Expert Review of Neurotherapeutics, 10*(8), 1295–1305.

Brown, S. D., & Harris, G. (2012). Disliked food acting as a contaminant during infancy. A disgust based motivation for rejection. *Appetite, 58*(2), 535–538.

Brown, S. D., Harris, G., Bell, L., & Lines, L. M. (2012). Disliked food acting as a contaminant in a sample of young children. *Appetite, 58*(3), 991–996.

Bryce, J., Boschi-Pinto, C., Shibuya, K., Black, R. E., & the WHO Child Health Epidemiology Reference Group. (2005). WHO estimates of the causes of death in children. *Lancet, 365*, 1147–1152.

Buttelmann, D., & Böhm, R. (2014). The ontogeny of the motivation that underlies in-group bias. *Psychological Science, 25*(4), 921–927.

Cameron, C. D., Lindquist, K. A., & Gray, K. (2015). A constructionist review of morality and emotions: No evidence for specific links between moral content and discrete emotions. *Personality and Social Psychology Review, 19*(4), 371–394.

Camras, L. A., & Allison, K. (1985). Children's understanding of emotional facial expressions and verbal labels. *Journal of Nonverbal Behavior, 9*(2), 84–94.

Camras, L. A., Bakeman, R., Chen, Y., Norris, K., & Cain, T. R. (2006). Culture, ethnicity, and children's facial expressions: A study of European American, mainland Chinese, Chinese American, and adopted Chinese girls. *Emotion, 6*(1), 103–114.

Cannon, P. R., Schnall, S., & White, M. (2011). Transgressions and expressions: Affective facial muscle activity predicts moral judgments. *Social Psychological and Personality Science, 2*(3), 325–331.

Carr, D., & Friedman, M. A. (2005). Is obesity stigmatizing? Body weight, perceived discrimination, and psychological well-being in the United States. *Journal of Health and Social Behavior, 46*(3), 244–259.

Case, T. I., Repacholi, B. M., & Stevenson, R. J. (2006). My baby doesn't smell as bad as yours: The plasticity of disgust. *Evolution and Human Behavior, 27*, 357–365.

Cashdan, E. (1994). A sensitive period for learning about food. *Human Nature, 5*(3), 279–291.

Chapman, H. A., & Anderson, A. K. (2012). Understanding disgust. *Annals of the New York Academy of Sciences, 1251*(1), 62–76.

Chapman, H. A., Kim, D. A., Susskind, J. M., & Anderson, A. K. (2009). In bad taste: Evidence for the oral origins of moral disgust. *Science, 323*(5918), 1222–1226.

Cottrell, C. A., & Neuberg, S. L. (2005). Different emotional reactions to different groups: A Sociofunctional threat-based approach to "prejudice". *Journal of Personality and Social Psychology, 88*(5), 770–789.

Crivelli, C., & Fridlund, A. J. (2018). Facial displays are tools for social influence. *Trends in Cognitive Sciences, 22*(5), 388–399.

Curtis, V. (2011). Why disgust matters. *Philosophical Transactions of the Royal Society B: Biological Sciences, 366*(1583), 3478–3490.

Curtis, V. (2013). *Don't look, don't touch, don't eat: The science behind revulsion*. Chicago, IL: University of Chicago Press.

Curtis, V., Aunger, R., & Rabie, T. (2004). Evidence that disgust evolved to protect from risk of disease. *Proceedings of the Royal Society B: Biological Sciences, 271*(Suppl_4), S131–S133.

Curtis, V., & Biran, A. (2001). Dirt, disgust, and disease: Is hygiene in our genes? *Perspectives in Biology and Medicine, 44*(1), 17–31.

Curtis, V., de Barra, M., & Aunger, R. (2011). Disgust as an adaptive system for disease avoidance behaviour. *Philosophical Transactions of the Royal Society B: Biological Sciences, 366*(1583), 389–401.

Curtis, V. A. (2014). Infection-avoidance behaviour in humans and other animals. *Trends in Immunology, 35*(10), 457–464.

Curtis, V. A., Danquah, L. O., & Aunger, R. V. (2009). Planned, motivated and habitual hygiene behaviour: An eleven country review. *Health Education Research, 24*(4), 655–673.

Danovitch, J., & Bloom, P. (2009). Children's extension of disgust to physical and moral events. *Emotion, 9*(1), 107–112.

Darwin, C. (1965). *The expression of the emotions in man and animals*. Chicago, IL: University of Chicago Press. (Original work published 1872).

Davey, G. C. L. (2011). Disgust: The disease-avoidance emotion and its dysfunctions. *Philosophical Transactions of the Royal Society B: Biological Sciences, 366*(1583), 3453–3465.

Davey, G. C. L., Buckland, G., Tantow, B., & Dallos, R. (1998). Disgust and eating disorders. *European Eating Disorders Review, 6*(3), 201–211.

de Barra, M., Islam, M. S., & Curtis, V. (2014). Disgust sensitivity is not associated with health in a rural Bangladeshi sample. *PLoS One, 9*(6), e100444–e100447.

de Jong, P. J., Andrea, H., & Muris, P. (1997). Spider phobia in children: Disgust and fear before and after treatment. *Behaviour Research and Therapy, 35*, 559–562.

de Jong, P. J., & Merckelbach, H. (1998). Blood-injection-injury phobia and fear of spiders: Domain specific individual differences in disgust sensitivity. *Personality and Individual Differences, 24*, 153–158.

Deacon, B., & Olatunji, B. O. (2007). Specificity of disgust sensitivity in the prediction of behavioral avoidance in contamination fear. *Behaviour Research and Therapy, 45*(9), 2110–2120.

DeJesus, J. M., Gerdin, E., Sullivan, K. R., & Kinzler, K. D. (2019). Children judge others based on their food choices. *Journal of Experimental Child Psychology, 179*, 143–161.

DeJesus, J. M., Shutts, K., & Kinzler, K. D. (2015). Eww she sneezed! Contamination context affects children's food preferences and consumption. *Appetite, 87*, 303–309.

Douglas, M. (1966). *Purity and danger*. London, UK: Routledge.

Ekman, P. (1992). An argument for basic emotions. *Cognition & Emotion, 6*(3–4), 169–200.

Ekman, P., & Friesen, W. V. (1976). Measuring facial movement. *Environmental Psychology and Nonverbal Behavior, 1*(1), 56–75.

Ekman, P., Sorenson, E. R., & Friesen, W. V. (1969). Pan-cultural elements in facial displays of emotion. *Science, 164*(3875), 86–88.

Fallon, A. E., Rozin, P., & Pliner, P. (1984). The child's conception of food: The development of food rejections with special reference to disgust and contamination sensitivity. *Child Development, 55*, 566–575.

Faulkner, J., Schaller, M., Park, J. H., & Duncan, L. A. (2004). Evolved disease-avoidance mechanisms and contemporary xenophobic attitudes. *Group Processes & Intergroup Relations, 7*(4), 333–353.

Feder, Y. (2015). Contamination appraisals, pollution beliefs, and the role of cultural inheritance in shaping disease avoidance behavior. *Cognitive Science, 40*(6), 1561–1585.

Fessler, D. M. T., & Navarrete, C. D. (2003). Meat is good to taboo: Dietary proscriptions as a product of the interaction of psychological mechanisms and social processes. *Journal of Cognition and Culture, 3*(1), 1–40.

Fincher, C. L., & Thornhill, R. (2012). Parasite-stress promotes in-group assortative sociality: The cases of strong family ties and heightened religiosity. *Behavioral and Brain Sciences, 35*, 61–78.

Foa, E. B., & Kozak, M. J. (1995). DSM-IV field trial: Obsessive-compulsive disorder. *American Journal of Psychiatry, 152*, 90–96.

Freud, S. (2017). *Three essays on the theory of sexuality: The 1905 edition.* (U. Kistner, Trans.). London, UK: Verso. (Original work published 1905)

Gagnon, M., Gosselin, P., Hudon-ven Der Buhs, I., Larocque, K., & Milliard, K. (2010). Children's recognition and discrimination of fear and disgust facial expressions. *Journal of Nonverbal Behavior, 34*(1), 27–42.

Galef, B. G. (1989). Enduring social enhancement of rats' preferences for the palatable and the piquant. *Appetite, 13*, 81–92.

Gere, A., Székely, G., Kovács, S., Kókai, Z., & Sipos, L. (2017). Readiness to adopt insects in Hungary: A case study. *Food Quality and Preference, 59*, 81–86.

Gilbert, A. N., Fridlund, A. J., & Sabini, J. (1987). Hedonic and social determinants of facial displays to odors. *Chemical Senses, 12*(2), 355–363.

Giner-Sorolla, R., & Chapman, H. A. (2017). Beyond purity. *Psychological Science, 28*(1), 80–91.

Goldenberg, J. L., Pyszczynski, T., Greenberg, J., Solomon, S., Kluck, B., & Cornwell, R. (2001). I am not an animal: Mortality salience, disgust, and the denial of human creatureliness. *Journal of Experimental Psychology: General, 130*(3), 427–435.

Grill, H. J., & Norgren, R. (1978). The taste reactivity test. II. Mimetic responses to gustatory stimuli in chronic thalamic and chronic decerebrate rats. *Brain Research, 143*(2), 281–297.

Haidt, J., McCauley, C., & Rozin, P. (1994). Individual differences in sensitivity to disgust: A scale sampling seven domains of disgust elicitors. *Personality and Individual Differences, 16*(5), 701–713.

Haidt, J., Rozin, P., McCauley, C., & Imada, S. (1997). Body, psyche, and culture: The relationship between disgust and morality. *Psychology and Developing Societies, 9*(1), 107–131.

Hamlin, J. K., Wynn, K., & Bloom, P. (2007). Social evaluation by preverbal infants. *Nature, 450*(7169), 557–560.

Harris, L. T., & Fiske, S. T. (2006). Dehumanizing the lowest of the low: Neuroimaging responses to extreme out-groups. *Psychological Science, 17*(10), 847–853.

Harris, M. (1985). *Good to eat: Riddles of food and culture*. Long Grove, IL: Waveland Press.

Hart, B. L. (1990). Behavioral adaptations to pathogens and parasites: Five strategies. *Neuroscience and Biobehavioral Reviews, 14*(3), 273–294.

Hartmann, C., Shi, J., Giusto, A., & Siegrist, M. (2015). The psychology of eating insects: A cross-cultural comparison between Germany and China. *Food Quality and Preference, 44*, 148–156.

Harvey, T., Troop, N. A., Treasure, J. I., & Murphy, T. (2002). Fear, disgust, and abnormal eating attitudes: A preliminary study. *International Journal of Eating Disorders, 32*(2), 213–218.

Hayes, C. J., Stevenson, R. J., & Coltheart, M. (2007). Disgust and Huntington's disease. *Neuropsychologia, 45*(6), 1135–1151.

Hejmadi, A., Rozin, P., & Siegal, M. (2004). Once in contact, always in contact: Contagious essence and conceptions of purification in American and Hindu Indian children. *Developmental Psychology, 40*(4), 467–476.

Henrich, J., & Henrich, N. (2010). The evolution of cultural adaptations: Fijian food taboos protect against dangerous marine toxins. *Proceedings of the Royal Society B: Biological Sciences, 277*(1701), 3715–3724.

Herz, R. (2012). *That's disgusting: Unraveling the mysteries of repulsion*. New York, NY: Norton.

Hodson, G., Choma, B. L., Boisvert, J., Hafer, C. L., MacInnis, C. C., & Costello, K. (2013). The role of intergroup disgust in predicting negative outgroup evaluations. *Journal of Experimental Social Psychology, 49*(2), 195–205.

Hodson, G., & Costello, K. (2007). Interpersonal disgust, ideological orientations, and dehumanization as predictors of intergroup attitudes. *Psychological Science, 18*(8), 691–698.

Inbar, Y., Pizarro, D., Iyer, R., & Haidt, J. (2012). Disgust sensitivity, political conservatism, and voting. *Social Psychological and Personality Science, 3*(5), 537–544.

Inbar, Y., Pizarro, D. A., & Bloom, P. (2009). Conservatives are more easily disgusted than liberals. *Cognition & Emotion, 23*(4), 714–725.

Izard, C. E. (1994). Innate and universal facial expressions: Evidence from developmental and cross-cultural research. *Psychological Bulletin, 115*(2), 288–299.

Izard, C. E., Huebner, R. R., Risser, D., & Dougherty, L. (1980). The young infant's ability to produce discrete emotion expressions. *Developmental Psychology, 16*(2), 132.

Jabbi, M., Bastiaansen, J., & Keysers, C. (2008). A common anterior insula representation of disgust observation, experience and imagination shows divergent functional connectivity pathways. *PLoS One, 3*(8), e2939.

Jäncke, L., & Kaufmann, N. (1994). Facial EMG responses to odors in solitude and with an audience. *Chemical Senses, 19*(2), 99–111.

Kalish, C. W. (1998). Young children's predictions of illness: Failure to recognize probabilistic causation. *Developmental Psychology, 34*(5), 1046–1058.

Kalyva, E., Pellizzoni, S., Tavano, A., Iannello, P., & Siegal, M. (2010). Contamination sensitivity in autism, Down syndrome, and typical development. *Research in Autism Spectrum Disorders, 4*(1), 43–50.

Kauer, J., Pelchat, M. L., Rozin, P., & Zickgraf, H. F. (2015). Adult picky eating: Phenomenology, taste sensitivity, and psychological correlates. *Appetite, 90*, 219–228.

Keeler, R. F., & Tu, A. T. (1991). *Handbook of natural toxins: Toxicology of plant and fungal compounds* (Vol. 6). New York, NY: Marcel Dekker Inc.

Kelly, D. (2011). *Yuck! The nature and moral significance of disgust*. Cambridge, MA: MIT Press.

Kiesecker, J. M., Skelly, D. K., Beard, K. H., & Preisser, E. (1999). Behavioral reduction of infection risk. *Proceedings of the National Academy of Sciences, 96*(16), 9165–9168.

Knutson, K. L., Spiegel, K., Penev, P., & Van Cauter, E. (2007). The metabolic consequences of sleep deprivation. *Sleep Medicine Reviews, 11*(3), 163–178.

Kochanska, G., Tjebkes, T. L., & Forman, D. R. (1998). Children's emerging regulation of conduct: Restraint, compliance, and internalization from infancy to the second year. *Child Development, 69*(5), 1378–1389.

Kollareth, D., & Russell, J. A. (2017). Is it disgusting to be reminded that you are an animal? *Cognition & Emotion, 31*(7), 1318–1332.

Kolnai, A. (2004). *On disgust*. (B. Smith & C. Korsmeyer, Eds.). Peru, IL: Open Court. (Original work published 1929)

Kupfer, T. R., & Giner-Sorolla, R. (2017). Communicating moral motives: The social signaling function of disgust. *Social Psychological and Personality Science, 8*(6), 632–640.

Kurzban, R., & Leary, M. R. (2001). Evolutionary origins of stigmatization: The functions of social exclusion. *Psychological Bulletin, 127*(2), 187–208.

Lafraire, J., Rioux, C., Giboreau, A., & Picard, D. (2016). Food rejections in children: Cognitive and social/environmental factors involved in food neophobia and picky/fussy eating behavior. *Appetite, 96(C)*, 347–357.

Landy, J. F., & Goodwin, G. P. (2015). Does incidental disgust amplify moral judgment? A meta-analytic review of experimental evidence. *Perspectives on Psychological Science, 10*(4), 518–536.

Legare, C. H., Evans, E. M., Rosengren, K. S., & Harris, P. L. (2012). The coexistence of natural and supernatural explanations across cultures and development. *Child Development, 83*(3), 779–793.

Legare, C. H., & Gelman, S. A. (2008). Bewitchment, biology, or both: The co-existence of natural and supernatural explanatory frameworks across development. *Cognitive Science, 32*(4), 607–642.

Legare, C. H., & Gelman, S. A. (2009). South African children's understanding of AIDS and flu: Investigating conceptual understanding of cause, treatment and prevention. *Journal of Cognition and Culture, 9*(3), 333–346.

Legare, C. H., Wellman, H. M., & Gelman, S. A. (2009). Evidence for an explanation advantage in naïve biological reasoning. *Cognitive Psychology, 58*(2), 177–194.

Lewis, M., Sullivan, M. W., & Vasen, A. (1987). Making faces: Age and emotion differences in the posing of emotional expressions. *Developmental Psychology, 23*(5), 690–697.

Liberman, Z., Kinzler, K. D., & Woodward, A. L. (2014). Friends or foes: Infants use shared evaluations to infer others' social relationships. *Journal of Experimental Psychology: General, 143*(3), 966–971.

Liberman, Z., Woodward, A. L., Sullivan, K. R., & Kinzler, K. D. (2016). Early emerging system for reasoning about the social nature of food. *Proceedings of the National Academy of Sciences, 113*(34), 9480–9485.

Lindquist, K. A., Wager, T. D., Kober, H., Bliss-Moreau, E., & Barrett, L. F. (2012). The brain basis of emotion: A meta-analytic review. *Behavioral and Brain Sciences, 35*(3), 121–143.

Lumeng, J. C., Cardinal, T. M., Jankowski, M., Kaciroti, N., & Gelman, S. A. (2008). Children's use of adult testimony to guide food selection. *Appetite, 51*(2), 302–310.

Lumeng, J. C., Miller, A., Peterson, K. E., Kaciroti, N., Sturza, J., Rosenblum, K., & Vazquez, D. M. (2014). Diurnal cortisol pattern, eating behaviors and overweight in low-income preschool-aged children. *Appetite, 73*, 65–72.

Lumley, M. A., & Melamed, B. G. (1992). Blood phobics and nonphobics: Psychological differences and affect during exposure. *Behaviour Research and Therapy, 30*(5), 425–434.

Malterud, K., & Ulriksen, K. (2011). Obesity, stigma, and responsibility in health care: A synthesis of qualitative studies. *International Journal of Qualitative Studies on Health and Well-Being, 6*(4), 8404.

Mancini, G., Agnoli, S., Baldaro, B., Ricci Bitti, P. E., & Surcinelli, P. (2013). Facial expressions of emotions: Recognition accuracy and affective reactions during late childhood. *The Journal of Psychology, 147*(6), 599–617.

McKay, D., & Tsao, S. D. (2005). A treatment most foul: Handling disgust in cognitive-behavior therapy. *Journal of Cognitive Psychotherapy, 19*(4), 355–367.

McMichael, C., & Robinson, P. (2016). Drivers of sustained hygiene behaviour change: A case study from mid-western Nepal. *Social Science & Medicine, 163*, 28–36.

Megido, R. C., Gierts, C., Blecker, C., Brostaux, Y., Haubruge, É., Alabi, T., & Francis, F. (2016). Consumer acceptance of insect-based alternative meat products in Western countries. *Food Quality and Preference, 52*, 237–243.

Meissner, K., Muth, E. R., & Herbert, B. M. (2011). Bradygastric activity of the stomach predicts disgust sensitivity and perceived disgust intensity. *Biological Psychology, 86*(1), 9–16.

Mennella, J. A., Pepino, M. Y., & Reed, D. R. (2005). Genetic and environmental determinants of bitter perception and sweet preferences. *Pediatrics, 115*(2), e216–e222.

Menninghaus, W. (2003). *Disgust: The theory and history of a strong sensation*. Albany, NY: State University of New York Press.

Meyer-Rochow, V. (2009). Food taboos: Their origins and purposes. *Journal of Ethnobiology and Ethnomedicine, 5*(1), 18.

Miller, W. I. (1997). *The anatomy of disgust*. Cambridge, MA: Harvard University Press.

Mitchell, I. J., Heims, H., Neville, E. A., & Rickards, H. (2005). Huntington's disease patients show impaired perception of disgust in the gustatory and olfactory modalities. *The Journal of Neuropsychiatry and Clinical Neurosciences, 17*(1), 119–121.

Moretz, M. W., & McKay, D. (2008). Disgust sensitivity as a predictor of obsessive-compulsive contamination symptoms and associated cognitions. *Journal of Anxiety Disorders, 22*, 707–715.

Moretz, M. W., Rogove, J., & McKay, D. (2011). The role of disgust in childhood anxiety disorders. In D. McKay, E. A. Storch, D. McKay, & E. A. Storch (Eds.), *Handbook of child and adolescent anxiety disorders* (pp. 155–170). New York, NY: Springer.

Muris, P., Huijding, J., Mayer, B., & de Vries, H. (2012). Does 'yuck' mean 'eek'? Fear responses in children after a disgust manipulation. *Journal of Behavior Therapy and Experimental Psychology, 43*, 765–769.

Muris, P., Huijding, J., Mayer, B., Langkamp, M., Reyhan, E., & Olatunji, B. (2012). Assessment of disgust sensitivity in children with an age-downward version of the Disgust Emotion Scale. *Behavior Therapy, 43*(4), 876–886.

Muris, P., Mayer, B., Borth, M., & Vos, M. (2013). Nonverbal and verbal transmission of disgust from mothers to offspring: Effects on children's evaluation of a novel animal. *Behavior Therapy, 44*(2), 293–301.

Muris, P., Mayer, B., Huijding, J., & Konings, T. (2008). A dirty animal is a scary animal! Effects of disgust-related information on fear beliefs in children. *Behaviour Research and Therapy, 46*(1), 137–144.

Muris, P., Merckelbach, H., Nederkoorn, S., Rassin, E., Candel, I., & Horselenberg, R. (2000). Disgust and psychopathological symptoms in a nonclinical sample. *Personality and Individuals Differences, 29*, 1163–1167.

Muris, P., van der Heiden, S., & Rassin, E. (2008). Disgust sensitivity and psychopathological symptoms in nonclinical children. *Journal of Behavior Therapy and Experimental Psychiatry, 39*(2), 133–146.

Nabi, R. L. (2002). The theoretical versus the lay meaning of disgust: Implications for emotion research. *Cognition & Emotion, 16*(5), 695–703.

Navarrete, C. D., & Fessler, D. M. T. (2006). Disease avoidance and ethnocentrism: The effects of disease vulnerability and disgust sensitivity on intergroup attitudes. *Evolution and Human Behavior, 27*(4), 270–282.

Nemeroff, C., & Rozin, P. (1994). The contagion concept in adult thinking in the United States: Transmission of germs and of interpersonal influence. *Ethos, 22*(2), 158–186.

Neziroglu, F., Hickey, M., & McKay, D. (2010). Psychophysiological and self-report components of disgust in body dysmorphic disorder: The effects of repeated exposure. *International Journal of Cognitive Therapy, 3*(1), 40–51.

Nussbaum, M. (2004). *Hiding from humanity: Disgust, shame, and the law*. Princeton, NJ: Princeton University Press.

Oar, E. L., Farrell, L. J., & Ollendick, T. H. (2015). One session treatment for specific phobias: An adaptation for paediatric blood–injection–injury phobia in youth. *Clinical Child and Family Psychology Review, 18*(4), 370–394.

Oaten, M., Stevenson, R. J., & Case, T. I. (2009). Disgust as a disease-avoidance mechanism. *Psychological Bulletin, 135*(2), 303–321.

Oaten, M., Stevenson, R. J., & Case, T. I. (2011). Disease avoidance as a functional basis for stigmatization. *Philosophical Transactions of the Royal Society B: Biological Sciences, 366*(1583), 3433–3452.

Oaten, M., Stevenson, R. J., Wagland, P., Case, T. I., & Repacholi, B. M. (2014). Parent-child transmission of disgust and hand hygiene: The role of vocalizations, gestures and other parental responses. *The Psychological Record, 64*(4), 803–811.

Olatunji, B. O., Lohr, J. M., Sawchuk, C. N., & Patten, K. (2007). Fear and disgust responding to heterogeneous blood-injection-injury stimuli: Distinctions from anxiety symptoms. *Journal of Psychopathology and Behavioral Assessment, 29*(1), 1–8.

Olatunji, B. O., & McKay, D. (Eds.). (2009). *Disgust and its disorders: Theory, assessment, and treatment implications*. Washington, D.C.: American Psychological Association.

Olatunji, B. O., Williams, N. L., Lohr, J. M., & Sawchuk, C. N. (2005). The structure of disgust: Domain specificity in relation to contamination ideation and excessive washing. *Behaviour Research and Therapy, 43*(8), 1069–1086.

Olatunji, B. O., Williams, N. L., Tolin, D. F., Abramowitz, J. S., Sawchuk, C. N., Lohr, J. M., & Elwood, L. S. (2007). The Disgust Scale: Item analysis, factor structure, and suggestions for refinement. *Psychological Assessment, 19*(3), 281–297.

Page, A. C. (2003). The role of disgust in faintness elicited by blood and injection stimuli. *Journal of Anxiety Disorders, 17*, 45–58.

Park, J. H., Schaller, M., & Crandall, C. S. (2007). Pathogen-avoidance mechanisms and the stigmatization of obese people. *Evolution and Human Behavior, 28*(6), 410–414.

Peryam, D. R. (1963). The acceptance of novel foods. *Food Technology, 17*, 33–39.

Petersen, M. B. (2017). Healthy out-group members are represented psychologically as infected in-group members. *Psychological Science, 28*(12), 1857–1863.

Phelan, S. M., Burgess, D. J., Yeazel, M. W., Hellerstedt, W. L., Griffin, J. M., & Ryn, V. M. (2015). Impact of weight bias and stigma on quality of care and outcomes for patients with obesity. *Obesity Reviews, 16*(4), 319–326.

Phillips, M. L., Senior, C., Fahy, T., & David, A. S. (1998). Disgust: The forgotten emotion of psychiatry. *The British Journal of Psychiatry, 172*, 373–375.

Phillips, M. L., Young, A. W., Senior, C., Brammer, M., Andrew, C., Calder, A. J., … David, A. S. (1997). A specific neural substrate for perceiving facial expressions of disgust. *Nature, 389*(6650), 495–498.

Prokop, P., & Fančovičová, J. (2016). Mothers are less disgust sensitive than childless females. *Personality and Individual Differences, 96*, 65–69.

Puhl, R. M., & Brownell, K. D. (2001). Bias, discrimination, and obesity. *Obesity Research, 9*(12), 788–805.

Puhl, R. M., & Heuer, C. A. (2010). Obesity stigma: Important considerations for public health. *American Journal of Public Health, 100*(6), 1019–1028.

Rakison, D. H., & Oakes, L. M. (Eds.). (2003). *Early category and concept development*. New York, NY: Oxford University Press.

Raman, L., & Gelman, S. A. (2008). Do children endorse psychosocial factors in the transmission of illness and disgust? *Developmental Psychology, 44*(3), 801–813.

Raudenbush, B., & Capiola, A. (2012). Physiological responses of food neophobics and food neophilics to food and non-food stimuli. *Appetite, 58*(3), 1106–1108.

Reed, D. R., & Knaapila, A. (2010). Genetics of taste and smell: Poisons and pleasures. *Progress in Molecular Biology and Translational Science, 94*, 213–240.

Reicher, S. D., Templeton, A., Neville, F., Ferrari, L., & Drury, J. (2016). Core disgust is attenuated by ingroup relations. *Proceedings of the National Academy of Sciences, 113*(10), 2631–2635.

Reisenzein, R., Studtmann, M., & Horstmann, G. (2013). Coherence between emotion and facial expression: Evidence from laboratory experiments. *Emotion Review, 5*(1), 16–23.

Rodger, H., Vizioli, L., Ouyang, X., & Caldara, R. (2015). Mapping the development of facial expression recognition. *Developmental Science, 18*(6), 926–939.

Rosenstein, D., & Oster, H. (1988). Differential facial responses to four basic tastes in newborns. *Child Development, 59*(6), 1555–1568.

Rottman, J. (2014). Evolution, development, and the emergence of disgust. *Evolutionary Psychology, 12*(2), 417–433.

Rottman, J., DeJesus, J. M., & Gerdin, E. (2018). The social origins of disgust. In N. Strohminger & V. Kumar (Eds.), *The moral psychology of disgust* (pp. 27–52). London, UK: Rowman & Littlefield.

Rottman, J., Johnston, A. M., Bierhoff, S., Pelletier, T., Grigoreva, A. D., & Benitez, J. (2019). *In sickness and in filth: Developing a disdain for dirty people*. Manuscript submitted for publication.

Rottman, J., & Kelemen, D. (2012). Aliens behaving badly: Children's acquisition of novel purity-based morals. *Cognition, 124*(3), 356–360.

Rottman, J., Kelemen, D., & Young, L. (2014). Tainting the soul: Purity concerns predict moral judgments of suicide. *Cognition, 130*(2), 217–226.

Rottman, J., Young, L., & Kelemen, D. (2017). The impact of testimony on children's moralization of novel actions. *Emotion, 17*(5), 811–827.

Royzman, E. B., Atanasov, P., Landy, J. F., Parks, A., & Gepty, A. (2014). CAD or MAD? Anger (not disgust) as the predominant response to pathogen-free violations of the divinity code. *Emotion, 14*(5), 892–907.

Royzman, E. B., & Sabini, J. (2001). Something it takes to be an emotion: The interesting case of disgust. *Journal for the Theory of Social Behaviour, 31*(1), 29–59.

Rozin, P. (1990). Development in the food domain. *Developmental Psychology, 26*(4), 555–562.

Rozin, P. (2008). Hedonic "adaptation": Specific habituation to disgust/death elicitors as a result of dissecting a cadaver. *Judgment and Decision Making, 3*(2), 191–194.

Rozin, P., Fallon, A., & Augustoni-Ziskind, M. (1985). The child's conception of food: The development of contamination sensitivity to 'disgusting' substances. *Developmental Psychology, 21*(6), 1075–1079.

Rozin, P., & Fallon, A. E. (1987). A perspective on disgust. *Psychological Review, 94*, 23–41.

Rozin, P., Haddad, B., Nemeroff, C., & Slovic, P. (2015). Psychological aspects of the rejection of recycled water: Contamination, purification and disgust. *Judgment and Decision Making, 10*(1), 50–63.

Rozin, P., Haidt, J., & Fincher, K. (2009). From oral to moral. *Science, 323*, 1179–1180.

Rozin, P., Haidt, J., & McCauley, C. R. (2016). Disgust. In L. F. Barrett, M. Lewis, & J. M. Haviland-Jones (Eds.), *Handbook of emotions* (4th ed., pp. 815–834). New York, NY: Guilford Press.

Rozin, P., Hammer, L., Oster, H., Horowitz, T., & Marmora, V. (1986). The child's conception of food: Differentiation of categories of rejected substances in the 16 months to 5 year age range. *Appetite, 7*(2), 141–151.

Rozin, P., Lowery, L., Imada, S., & Haidt, J. (1999). The CAD triad hypothesis: A mapping between three moral emotions (contempt, anger, disgust) and three moral codes (community, autonomy, divinity). *Journal of Personality and Social Psychology, 76*(4), 574–586.

Rozin, P., Nemeroff, C., Horowitz, M., Gordon, B., & Voet, W. (1995). The borders of the self: Contamination sensitivity and potency of the body apertures and other body parts. *Journal of Research in Personality, 29*(3), 318–340.

Rozin, P., & Schiller, D. (1980). The nature and acquisition of a preference for chili pepper by humans. *Motivation and Emotion, 4*(1), 77–101.

Ruba, A. L., Johnson, K. M., Harris, L. T., & Wilbourn, M. P. (2017). Developmental changes in infants' categorization of anger and disgust facial expressions. *Developmental Psychology, 53*(10), 1826–1832.

Ruby, M. B., Rozin, P., & Chan, C. (2015). Determinants of willingness to eat insects in the USA and India. *Journal of Insects as Food and Feed, 1*(3), 215–225.

Russell, J. A. (1994). Is there universal recognition of emotion from facial expression? A review of the cross-cultural studies. *Psychological Bulletin, 115*(1), 102–141.

Russell, P. S., & Giner-Sorolla, R. (2013). Bodily moral disgust: What it is, how it is different from anger, and why it is an unreasoned emotion. *Psychological Bulletin, 139*(2), 328–351.

Sandberg, H. (2007). A matter of looks: The framing of obesity in four Swedish daily newspapers. *Communications, 32*, 447–472.

Sawchuk, C. N. (2009). The acquisition and maintenance of disgust: Developmental and learning perspectives. In B. O. Olatunji & D. McKay (Eds.), *Disgust and its disorders: Theory, assessment, and treatment implications* (pp. 77–97). Washington, D.C: American Psychological Association.

Sawchuk, C. N., Lohr, J. M., Westendorf, D. H., Meunier, S. A., & Tolin, D. F. (2002). Emotional responding to fearful and disgusting stimuli in specific phobics. *Behaviour Research and Therapy, 40*(9), 1031–1046.

Schaich Borg, J., Lieberman, D., & Kiehl, K. A. (2008). Infection, incest, and iniquity: Investigating the neural correlates of disgust and morality. *Journal of Cognitive Neuroscience, 20*(9), 1529–1546.

Schaller, M. (2011). The behavioural immune system and the psychology of human sociality. *Philosophical Transactions of the Royal Society B, 366*(1583), 3418–3426.

Schaller, M., & Park, J. H. (2011). The behavioral immune system (and why it matters). *Current Directions in Psychological Science, 20*(2), 99–103.

Schienle, A., Stark, R., Walter, B., Blecker, C., Ott, U., Kirsch, P., … Vaitl, D. (2002). The insula is not specifically involved in disgust processing: An fMRI study. *Neuroreport, 13*(16), 2023–2026.

Schnall, S., Haidt, J., Clore, G. L., & Jordan, A. H. (2008). Disgust as embodied moral judgment. *Personality and Social Psychology Bulletin, 34*(8), 1096–1109.

Schwartz, M. B., Chambliss, H. O. N., Brownell, K. D., Blair, S. N., & Billington, C. (2003). Weight bias among health professionals specializing in obesity. *Obesity Research, 11*(9), 1033–1039.

Shenhav, A., & Mendes, W. B. (2014). Aiming for the stomach and hitting the heart: Dissociable triggers and sources for disgust reactions. *Emotion, 14*(2), 301–309.

Shutts, K., Kinzler, K. D., & DeJesus, J. M. (2013). Understanding infants' and children's social learning about foods: Previous research and new prospects. *Developmental Psychology, 49*(3), 419–425.

Shutts, K., Kinzler, K. D., McKee, C. B., & Spelke, E. S. (2009). Social information guides infants' selection of foods. *Journal of Cognition and Development, 10*(1–2), 1–17.

Siegal, M., Fadda, R., & Overton, P. G. (2011). Contamination sensitivity and the development of disease-avoidant behaviour. *Philosophical Transactions of the Royal Society B: Biological Sciences, 366*(1583), 3427–3432.

Siegal, M., & Share, D. L. (1990). Contamination sensitivity in young children. *Developmental Psychology, 26*(3), 455–458.

Simpson, J., Carter, S., Anthony, S. H., & Overton, P. G. (2006). Is disgust a homogeneous emotion? *Motivation and Emotion, 30*(1), 31–41.

Slaughter, V., & Griffiths, M. (2007). Death understanding and fear of death in young children. *Clinical Child Psychology and Psychiatry, 12*(4), 525–535.

Smith, D. L. (2011). *Less than human: Why we demean, enslave, and exterminate others*. New York, NY: St. Martin's Press.

Solomon, G. E. A., & Cassimatis, N. L. (1999). On facts and conceptual systems: Young children's integration of their understandings of germs and contagion. *Developmental Psychology, 35*(1), 113–126.

Soussignan, R., & Schaal, B. (1996). Children's facial responsiveness to odors: Influences of hedonic valence of odor, gender, age, and social presence. *Developmental Psychology, 32*(2), 367–379.

Soussignan, R., Schaal, B., Marlier, L., & Jiang, T. (1997). Facial and autonomic responses to biological and artificial olfactory stimuli in human neonates: Re-examining early hedonic discrimination of odors. *Physiology & Behavior, 62*(4), 745–758.

Speece, M. W., & Brent, S. B. (1984). Children's understanding of death: A review of three components of a death concept. *Child Development, 55*, 1671–1686.

Speltini, G., & Passini, S. (2014). Cleanliness/dirtiness, purity/impurity as social and psychological issues. *Culture & Psychology, 20*(2), 203–219.

Speth, J. D. (2017). Putrid meat and fish in the Eurasian Middle and Upper Paleolithic: Are we missing a key part of Neanderthal and modern human diet? *PaleoAnthropology, 2017*, 44–72.

Stark, R., Walter, B., Schienle, A., & Vaitl, D. (2005). Psychophysiological correlates of disgust and disgust sensitivity. *Journal of Psychophysiology, 19*(1), 50–60.

Steckler, C. M., Liberman, Z., Van de Vondervoort, J. W., Slevinsky, J., Le, D. T., & Hamlin, J. K. (2018). Feeling out a link between feeling and infant sociomoral evaluation. *British Journal of Developmental Psychology, 36*(3), 482–500.

Steiner, J. E., Glaser, D., Hawilo, M. E., & Berridge, K. C. (2001). Comparative expression of hedonic impact: Affective reactions to taste by human infants and other primates. *Neuroscience & Biobehavioral Reviews, 25*(1), 53–74.

Stevenson, R., Oaten, M., Case, T., & Repacholi, B. (2014). Is disgust prepared? A preliminary examination in young children. *The Journal of General Psychology, 141*(4), 326–347.

Stevenson, R. J., Case, T. I., & Oaten, M. J. (2009). Frequency and recency of infection and their relationship with disgust and contamination sensitivity. *Evolution and Human Behavior, 30*(5), 363–368.

Stevenson, R. J., Oaten, M. J., Case, T. I., Repacholi, B. M., & Wagland, P. (2010). Children's response to adult disgust elicitors: Development and acquisition. *Developmental Psychology, 46*(1), 165–177.

Strauss, R. S., & Pollack, H. A. (2003). Social marginalization of overweight children. *Archives of Pediatrics & Adolescent Medicine, 157*(8), 746–752.

Strohminger, N. (2014). Disgust talked about. *Philosophy Compass, 9*(7), 478–493.

Strohminger, N., & Kumar, V. (Eds.). (2018). *The moral psychology of disgust*. London, UK: Rowman & Littlefield.

Thorpe, S. J., Patel, S. P., & Simonds, L. M. (2003). The relationship between disgust sensitivity, anxiety, and obsessions. *Behaviour Research and Therapy, 41*, 1397–1409.

Tolin, D. F., Lohr, J. M., Sawchuk, C. N., & Lee, T. C. (1997). Disgust and disgust sensitivity in blood-injection-injury and spider phobia. *Behaviour Research and Therapy, 35*, 949–953.

Tolin, D. F., Worhunsky, P., & Maltby, N. (2004). Sympathetic magic in contamination- related OCD. *Journal of Behavior Therapy and Experimental Psychiatry, 35*, 193–205.

Toyama, N. (2016). Adults' explanations and children's understanding of contagious illnesses, non-contagious illnesses, and injuries. *Early Child Development and Care, 186*(4), 526–543.

Tsao, S. D., & McKay, D. (2004). Behavioral avoidance tests and disgust in contamination fears: Distinctions from trait anxiety. *Behaviour Research and Therapy, 42*(2), 207–216.

Tybur, J. M., & Lieberman, D. (2016). Human pathogen avoidance adaptations. *Current Opinion in Psychology, 7*, 6–11.

Tybur, J. M., Lieberman, D., & Griskevicius, V. (2009). Microbes, mating, and morality: Individual differences in three functional domains of disgust. *Journal of Personality and Social Psychology, 97*(1), 103–122.

Tybur, J. M., Lieberman, D., Kurzban, R., & DeScioli, P. (2013). Disgust: Evolved function and structure. *Psychological Review, 120*(1), 65–84.

Van de Vondervoort, J. W., & Hamlin, J. K. (2018). The early emergence of sociomoral evaluation: Infants prefer prosocial others. *Current Opinion in Psychology, 20*, 77–81.

van Dongen, E. (2001). It isn't something to yodel about, but it exists! Faeces, nurses, social relations and status within a mental hospital. *Aging & Mental Health, 5*(3), 205–215.

van Huis, A., Van Itterbeeck, J., Klunder, H., Mertens, E., Halloran, A., Muir, G., & Vantomme, P. (2013). *Edible insects: Future prospects for food and feed security*. Rome, Italy: FAO.

Van Overveld, W. M., de Jong, P. J., Peters, M. L., Cavanagh, K., & Davey, G. L. (2006). Disgust propensity and disgust sensitivity: Separate constructs that are differentially related to specific fears. *Personality and Individual Differences, 41*(7), 1241–1252.

Ventura, A. K., & Mennella, J. A. (2011). Innate and learned preferences for sweet taste during childhood. *Current Opinion in Clinical Nutrition & Metabolic Care, 14*(4), 379–384.

Vernon, L. L., & Berenbaum, H. (2002). Disgust and fear in response to spiders. *Cognition and Emotion, 16*, 809–830.

Viar-Paxton, M. A., Ebesutani, C., Kim, E. H., Ollendick, T., Young, J., & Olatunji, B. O. (2015). Development and initial validation of the Child Disgust Scale. *Psychological Assessment, 27*(3), 1082–1096.

Vytal, K., & Hamann, S. (2010). Neuroimaging support for discrete neural correlates of basic emotions: A voxel-based meta-analysis. *Journal of Cognitive Neuroscience, 22*(12), 2864–2885.

Wagemans, F. M. A., Brandt, M. J., & Zeelenberg, M. (2018). Disgust sensitivity is primarily associated with purity-based moral judgments. *Emotion, 18*(2), 277–289.

Wardle, J., Guthrie, C. A., Sanderson, S., & Rapoport, L. (2001). Development of the children's eating behaviour questionnaire. *Journal of Child Psychology and Psychiatry, 42*(7), 963–970.

Wertz, A. E., & Wynn, K. (2014a). Selective social learning of plant edibility in 6- and 18-month-old infants. *Psychological Science, 25*(4), 874–882.

Wertz, A. E., & Wynn, K. (2014b). Thyme to touch: Infants possess strategies that protect them from dangers posed by plants. *Cognition, 130*(1), 44–49.

Wheatley, T., & Haidt, J. (2005). Hypnotic disgust makes moral judgments more severe. *Psychological Science, 16*(10), 780–784.

Widen, S. C., & Naab, P. (2012). Can an anger face also be scared? Malleability of facial expressions. *Emotion, 12*(5), 919–925.

Widen, S. C., Pochedly, J. T., Pieloch, K., & Russell, J. A. (2013). Introducing the sick face. *Motivation and Emotion, 37*(3), 550–557.

Widen, S. C., & Russell, J. A. (2008). Children's and adults' understanding of the 'disgust face'. *Cognition & Emotion, 22*(8), 1513–1541.

Widen, S. C., & Russell, J. A. (2013). Children's recognition of disgust in others. *Psychological Bulletin, 139*(2), 271–299.

Wilson, R. R. (2002). *The hydra's tale: Imagining disgust*. Edmonton, Alberta: The University of Alberta Press.

Wisneski, D. C., & Skitka, L. J. (2017). Moralization through moral shock: Exploring emotional antecedents to moral conviction. *Personality and Social Psychology Bulletin, 43*(2), 139–150.

Yoder, A. M., Widen, S. C., & Russell, J. A. (2016). The word disgust may refer to more than one emotion. *Emotion, 16*(3), 301–308.

Zickgraf, H. F., Franklin, M. E., & Rozin, P. (2016). Adult picky eaters with symptoms of Avoidant/Restrictive Food Intake Disorder: Comparable distress and comorbidity but different eating behaviors compared to those with disordered eating symptoms. *Journal of Eating Disorders, 4*(1), 26–37.

The Self-Conscious Emotions and the Role of Shame in Psychopathology

Michael Lewis

Abstract

The self-conscious emotions according to the theory presented here require two important features which develop in the first 3 years of life. These are consciousness, defined here as self-awareness as measured by self-recognition in mirrors, the onset of personal pronouns like "me" or "mine," and complex pretend play. These emerge between 15 and 24 months of age and give rise to self-conscious-exposed emotions such as embarrassment, envy, and empathy, as well as prosocial behaviors such as sharing and reciprocal play. Following these emotions and consciousness, a new set of emotions emerges, called self-conscious evaluative emotions, based upon children's ability to incorporate standards, rules, and goals of the society (SRGs) and be able to evaluate their behavior in terms of the SRGs as success or failure. These cognitions also contain whether children's focus is on their failure or not and, together with global or performance attributions, give rise to these self-conscious emotions. Shame, pride, and embarrassment in particular have been studied as to their relationship to the development of psychopathology. Shame, the most negative of these emotions, appears to mediate between trauma in the child's life, including abusive parenting, and subsequent symptoms of psychopathology.

Here we present a theory of the development of the self-conscious emotions which require the development of mentalism or the idea of me—called self-reflection or consciousness by some—as well as other cognitive and attributional processes, many of which require the child's socialization to their family and culture. To accomplish this task, it is necessary to question the nativistic idea that the human infant is born with the capacity to feel shame, an idea proposed by those who believe that facial expressions represent the emotion (Ekman & Friesen, 1975; Izard, 1971, 1977), as well as those who hold to the belief that infants have cognitive capacities to evaluate and choose between moral tasks (Hamlin & Wynn, 2011; see Salvadori et al., 2015 for a counter argument). Following this, the self-system will be discussed. Finally, a theory of emotions and emotional development is proposed, ending with a biological-attributional model suggested by Darwin's theory of self-conscious emotions.

M. Lewis (✉)
Rutgers Robert Wood Johnson Medical School, Department of Pediatrics, Institute for the Study of Child Development, New Brunswick, NJ, USA
e-mail: lewis@rwjms.rutgers.edu

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_13

Do Sunflowers Feel Joy and Sadness?

Because humans are capable of imparting meaning to inanimate objects such as clouds and mountains, as well as animate organisms such as birds, domesticated animals, and even flowers, presented here is an observation made last summer in a café in Montepulciano, Italy. It is meant as a tongue-in-cheek example of how readily one can attribute human-like feelings even to flowers.

> The field in front of me is planted with sunflowers, large flowers on long stems with yellow petals and dark brown centers. There are many rows of these flowers. Having been sitting here from early sunrise to sunset, I have studied the flowers' interaction with the sun. Prior to sunrise, the heads of the flowers hang down, but as the sun rose, their heads lifted and turned toward the sun. As the sun moved along the sky, they closely followed its' movement. There are individual differences in the flowers' interaction with the sun; some follow the sun closely, while a few turn more slowly. The flowers' close following appears to reflect their desire for the sun and when they face the sun, they appear content, their heads held high. It is amazing that the flowers are able to turn their heads toward the sun in synchrony with the sun's movement. As the sun set, the flowers' heads collapsed and bent showing their sadness as darkness approaches.

While we do not usually make claims about flowers and feeling, some do. The belief that talking to and giving loving care can affect plants' growth and development is certainly shared (Belck, 2017). In the discussion of the role of intention and desire from a developmental perspective (Lewis, 2003), the question was raised of how do we need think of intention and desire when speaking about plants or a 2-month-old infant who pulls a string to produce an effect, as well as the intention of an adult? We have shown that very young infants are able to pull a string to cause a picture to appear on a screen in front of them (Lewis, Sullivan, & Kim, 2015; Lewis, Sullivan, Ramsay, & Alessandri, 1992). Moreover, these 2-month-olds show remarkably the same behavior as 8-month-olds (Alessandri, Sullivan, & Lewis, 1990; Lewis, Alesandri, & Sullivan, 1990). That 2-month-old infants can learn to pull a string appears to be an intention to produce the picture, a finding further supported by the fact that once they have learned to pull the string to get the picture turned on, they will pull even harder if the picture fails to appear. Is it reasonable, then, to say that the 2-month-old infant intends in the same way that the adult intends to write a paper? The problems with doing so are many, first, because we then must concede that there is no development of intentions, something which Piaget (1936/1952) argued against over 80 years ago and, second, we fail to consider the role of consciousness in intentions. As such, we confuse competence with comprehension (Dennett, 2009). Moreover, as Putnam (1963) has warned us, just because an ant might be able to trace a face in the sand does not necessarily imply that the ant knows anything about faces.

The Development of Intentionality

It was Piaget (1936/1952) who offered us a developmental blueprint of the development of causality and intention in the opening years of life. In summary, in the earliest stages of development, children's actions are simply preadapted action patterns (Lewis, 2014). After a time, these action patterns produce (still without intention) outcomes. It is these outcomes that, in turn, produce the action patterns. Thus, *A* accidentally causes *B* (an effect), and *B*, in turn, produces *A*. Piaget characterizes this chain of events as a *simple circular action* pattern. Notice that the control of the action is associated with the simplest of mental representations. The representation is the association that *A* and *B* are mutually connected. Nevertheless, it is *B*, an environmental event (an effect in the world) that causes *A* (the action) to occur. I think it is safe to conclude that, for Piaget, the child starts the developmental process without intentions.

However, by the end of the first year of life, children "set out to obtain a certain result" (Piaget & Inhelder, 1969, p. 10). By now, the means, formerly *A* (both action and representation), has become independent of outcome, *B*. The mental representation associating *A* and *B*, which

appeared at the beginning of life, has now been separated. In a sense, Piaget describes the child as changing from reactive to active and from rote associative reproduction to the pursuit of a goal. Here, then, he starts to speak of intention. However, it is still a limited intentionality; it is only the separation of means and ends in the utilization of an *available* means for a new end. It is not until the end of the fifth stage (somewhere around 15 months) that intentionality is assumed. Interestingly, this age reappears when we talk about the development of consciousness (see Lewis & Ramsay, 2004a). For Piaget, intentionality makes possible the creation of goals and plans in the absence of external events and in the establishment of new schemata—multiple means associated with multiple ends.

However, we ultimately come to understand intention; it is obvious that the actions associated with outcomes of the 2-month-olds are not likely to be the same as those of 18–24-month-olds who have already acquired a self-referential stance. It is probably reasonable at least to draw a distinction between intentions of systems that do not have consciousness and those that do, which leads us in turn to consider the system properties of a self: one, as the machinery of the self, and two, as the idea of me, or the mental state of knowing about one's self from an epistemological point of view. Following James (1890), it has also been referred to as subjective self, like the machinery of the self, and as object self, as in "I know I know" or "I am." Let us explore these two aspects of a self-system as it may be helpful in thinking about different kinds of intention.

The Self System

Perhaps the first question is why we need the construct of self at all. For example, instead of the term *self regulation*, we could simply use the term *system regulation*. Self regulation implies something unique about the self. For each of the features of self that we articulate, we can ask the same question: What would the child be like if he does not have that self feature? It is obvious that for the earliest features of self, their absence would result in such maladaptive behavior that the organism could not survive, for example, failures of self-other differentiation or self-other interaction results in disorders that we can term *autism* or *retardation*. What happens when the final structural feature of self reference (termed *consciousness* or *objective self awareness*) emerges? What are the differences between children who have self referential abilities and those who are developmentally less advanced? From a developmental point of view, if we found no differences between a child who does or does not have self reference, then we might not need the term. If, in contrast, there was a difference between a child with or without a self referential system, this difference may be of importance.

In case of a self referential organism, we could expect it to show a variety of capabilities, including role-playing empathy, embarrassment, shame, guilt, pride (Lewis, 1992a), and achievement motivation (Heckhausen, 1984). It is that feature of the self, the self that can place itself in the role of other, which creates mature forms of empathy, that shows pride in its achievement, and that shows shame or guilt in its failure, that is needed. Before the emergence of the self, these behaviors remain absent or, at best, controlled by reflexive-like behavior. From the point of view argued here, humans and nonhumans share many features of self. Those features that we do not share, self referential behaviors, identity, and self concept, are what makes us different from other creatures and which make the child different from the infant.

The confusion of terms about a self can be seen in such articles as *Self – Nonself Discrimination by T Cells* (von Boehmer & Kisielow, 1990) or *Self-Incompatibility: A Self Recognition System in Plants* (Harding, Gray, McClure, Anderson, & Clarke, 1990). The confusion gets no better when we talk about the human infant and intersubjectivity (Stern, 1984) or infants' theory of mind (Baillargeon, Li, Gertner, & Wu, 2011) or moral behavior (Hamlin, 2013; Hamlin & Wynn, 2011). If we are to think of a self system, some aspects of it need consideration. These are stated as axioms underlying the theory used here.

All living systems self regulate. By this we mean that within any living system, there needs to be communication between parts of that system. This can include a unit as small as a cell, a plant or animal, or even a more complex organism. For example, as I sit here writing, my systems are self regulating my temperature, producing shivering as the room cools, or regulating my blood sugar level. Self regulation is a property of living matter. Self regulation makes no assumptions about a mental state or objective self awareness.

Some minimal differentiation between self and other is a necessary condition for action. Whether this differentiation is a product of experience or part of the process of action—including perceiving, feeling, and thinking—is unknown (see Butterworth, 1992). What appears to be so is that organisms cannot act without at some level being able to distinguish between self and other. It is part of the core processes of all living systems (Von Bertalanffy, 1967).

Even higher-order functions such as perception, thinking, and complex actions, such as driving a car, can be performed by adult humans without a mental state or objective self awareness, that is, without their being able to reflect on, look at, and observe the processes that allow these behaviors to be carried out. I cannot watch myself think. I can only look at the product of my thinking.

A unique aspect of some self systems is objective self awareness. By objective self awareness, I mean the capacity of a self to know it knows or to remember it remembers. It is this "meta" ability which we refer to when we say self awareness, the reflective capacity of objective self awareness, which may be uniquely human (perhaps we need to include the great apes who are capable of this). Once the emergence of consciousness occurs, processes of agency, originally part of the machinery of the self, come under the control at least some of the time of the conscious desires of the organism. Thus, although agency and intention exist from birth, the processes that support them undergo change.

Specific developmental processes of the self follow the general principles of development (Lewis, 1997). Earlier capacities, such as agency controlled by the machinery of the self, may give rise to later capacities, like mental states (e.g., the idea of "me"), but these capacities are not transformed: thus, agency controlled by the machinery of self exists once agency controlled by consciousness emerges. Thus, unlike a more classical genetic epistemological approach, retention of earlier functions is not only possible but also a necessary aspect of development. In some sense, then, old structures in interaction with the environment and/or as a function of maturation give rise to new structures. These new structures do not replace the old ones but coexist with them. Under certain conditions, individuals will utilize the most mature aspect they have achieved. However, this does not mean other aspects are not utilized. In some sense, then, mature adults possess within their repertoire all aspects of agency, whereas younger children or infants possess only those earlier aspects.

What Selves Know and Know They Do Not Know

The idea of a self is a particularly powerful one; it is an idea with which we cannot part. It is one around which a good portion of the network of many of our ideas center. This is not to say that what we know explicitly about ourselves is all we know. In fact, this idea of oneself is only one part of ourselves; there are many other parts of which we do not know. These have been called implicit knowledge by some. They also go by the name of unconscious or bodily knowledge. There are the activities of my body—the joints and muscles moving, the blood surging, the action potentials of my muscle movements, as well as the calcium exchange along the axons. We have no knowledge of a large number of our motives—organized, coherent thoughts and ideas that have been called unconscious—that control large segments of our lives. We have no explicit knowledge of how our thoughts occur. Nevertheless, we know that we do not know about how our thoughts occur. This part of us is explicit, it is our consciousness.

Although it might be true that we could explicitly know more of some parts of our implicit selves if we chose to, as in the control of the autonomic nervous system such as heart rate, it is nonetheless the case that what is known by our self-systems is greater than what we can state we know. If such facts are true, then, it is fair to suggest a metaphor of ourselves: a biological system that is an evolutionarily fit complex of processes—doing, feeling, thinking, planning, and learning. One aspect of this system is explicit; it is the idea of me. This idea or mental state knows itself and knows it does not know all of itself! Ourselves, then, are greater than the explicit self which is only a small portion of ourselves. The difference between ourselves and *me* also can be understood from an epistemological point of view. The idea that we know is not the same as the idea that we know we know. The explicit aspect of the self that is referred to here is that which knows it knows.

In the adult, we can refer to the core processes of self as "implicit consciousness," whereas the idea of me is "explicit consciousness." From this perspective, we can say that, for the adult human, both the implicit and explicit components are functional. The implicit aspect of the self is composed of the core processes of the body, or implicit consciousness; the other aspect is the idea of me, explicit consciousness—something that represents an emergent transformation of these core processes. Implicit consciousness appears to develop and operate even in sleep. Explicit consciousness, in contrast, is transient; that is, it can be functioning some of the time, or not functioning, much like Hilgard's (1977) idea of divided attention. From a developmental perspective, the core processes of self exist at birth, and the mental state of the idea of me emerges as a developmental transformation in the first 2 years of the child's life.

The Role of Selves in Development

The problem in studying development is that our studies usually divide the organism's cognitive, social, and emotional life into separate, discrete domains. Lost in this epistemological division is the relational idea of the organism itself. In terms of infants and young children, different studies provide different information, but with little attempt at unifying these separate domains. Thus, although we have separated out the role of explicit consciousness in cognitive, social, and emotional development (Lewis, 2010, 2014, 2015), it should be understood that these domains are connected with each other through children's developing mental state of themselves. The organization of development follows from the assumption that social, emotional, and cognitive knowledge are features of the same unified relational development system that is fundamental to the individual's explicit consciousness. Individuals develop social, emotional, and cognitive knowledge in relational bidirectional interactions with each other. Moreover, development is understood as a gradual differentiation among the various domains (Werner, 1961). The change from a unified system of knowledge based on the emergence of consciousness to one which is differentiated, integrated, and specialized occurs as a function of development (Mascolo & Fischer, 2010). I have described this like a tree, the trunk representing the unified and integrated system generated by consciousness, whereas the branches represent the separate areas of knowledge, some of which are interrelated, whereas others are independent. This model allows for both the integration of knowledge from a developmental perspective and the functional independence of the end product. Thus, as a central premise, the development of explicit consciousness provides the scaffolding for the development, integration, and separation of the various other behaviors of the child.

Figure 1 presents in schematic form the proposed relations. As can be seen, each of the early classes of behavior is transformed by the emergence of explicit consciousness. Thus, perceptual-sensory become a theory of mind, social interactions become social relationships, and the early action patterns become the self-conscious emotions. Elsewhere I have talked about social relations and perceptual-social schema (Lewis, 2010, 2015). Here we will focus on emotional development.

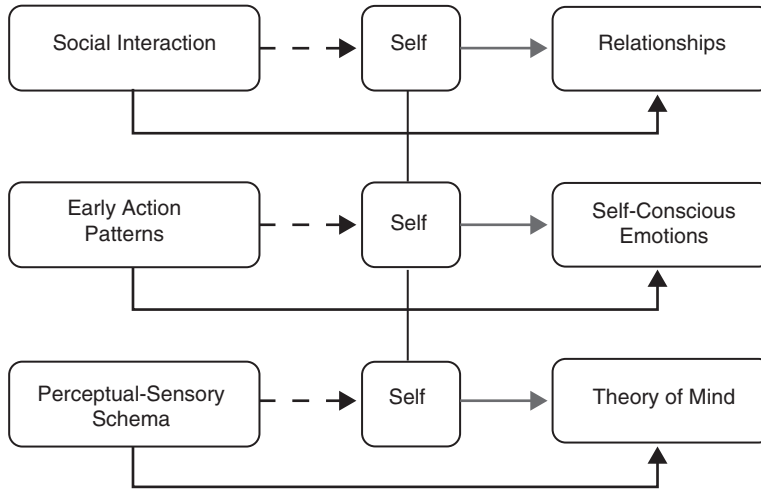

Fig. 1 Role of the self in development

Emotions and Explicit Consciousness

Considerable time has been spent on researching and writing about the relation between emotion and consciousness, and my book, *The Rise of Consciousness and the Development of Emotional Life* (2014), deals with this relationship in some detail. Briefly, then, a summary of this association will be given, leaving many of the details to be read elsewhere. Emotional life begins with the complex interaction of evolutionary derived action patterns which connect the infant with their social and physical world. These action patterns, much like innate releasing mechanisms, are not unique to humans but are part of evolutionary processes, some of which are unique to the human species. These early patterns differ by infant temperament and by the interaction of the child with its social world. It is not until the advent of mentalism and self-referential behaviors—as measured by self-recognition, personal pronoun usage, and pretend play, which occur by the second year of life—that these early patterns can be called emotions as feelings and, by the third year, the self-conscious emotions of shame, pride, and guilt.

Although the emotions that appear early have received considerable attention, the set of later-appearing emotions that are considered here have received relatively little attention. There are likely to be many reasons for this; one, these self-conscious emotions cannot be described solely by examining a particular set of facial movements, necessitating the observation of bodily action, as well as facial cues. A second reason for their neglect is the understanding that there are no clear specific elicitors of these particular emotions. Although happiness or joy is likely elicited by seeing a significant other, few specific situations will elicit shame, pride, guilt, or embarrassment. These self-conscious emotions require classes of events that only can be identified by the individuals in relation to thoughts about themselves.

The elicitation of self-conscious emotions involves elaborate cognitive processes that have, at their heart, mental states about the self or explicit consciousness. Although some theories, such as psychoanalysis (Erikson, 1950; Freud, 1936/1963; Tomkins, 1963), have argued for some universal elicitors of self-conscious emotions, such as exposure of the backside, failure at toilet training, or task interruption, the idea of an automatic noncognitive elicitor of these emotions does not make much sense. Cognitive processes must be the elicitors of these complex emotions (Lewis, 1992a; see also Darwin's ideas, 1872/1965, below). It is the way we think or what we think about that becomes the elicitor of these emotions. There may be a one-to-one correspondence between thinking certain

thoughts and the occurrence of a particular emotion; however, in the case of this class of emotions, the elicitor is a cognitive event. This does not mean that the earlier emotions, those called primary or basic, are elicited by noncognitive events. Cognitive factors may play a role in the elicitation of any emotion; however, the nature of cognitive events is much less articulated and differentiated in the earlier ones (Plutchik, 1980).

Darwin's Ideas on Self-Conscious Emotions

Darwin's work on the self-conscious emotions (1872/1965) is a good starting point in thinking about them since many of his observations have been shown to be correct, although his attempts at a theory needed further work. His idea of emotions as adaptive action patterns—that is, evolutionary evolved and innate ways of behaving in the face, body, and physiological responses to specific contexts (stimuli)—has been well received. His interest in the emotions which emerged later in infancy/toddlerhood, which he called the self-conscious emotions, has not received much attention nor were they systematically discussed, so we need to piece them together. Perhaps the best way to do so is to point out that Darwin used the concept of self attention as a marker around which his observations of people's behavior hung. He thought that the blushing response was a good measure of this self-attention, and his observations suggested that this emerged around 3 years of age. This age was long after the earlier action patterns he called fear, joy, and sadness were seen and demonstrated that he saw the continuing development with age of the child's emotional life. Unlike the earlier emotions, he understood that thoughts about what others think could be the elicitors of such new emotions as embarrassment. He did not attribute "thoughts about" to the earlier emotions. Interestingly enough, my elaboration of self attention or self focus as an index of self reflection also places its origin after the behaviors marking the early emotions (Lewis, 1992b).

Besides a self's thoughts about others' thoughts about themselves, Darwin had little knowledge about self attributions or cognitive development, as they were related to these emotions, which made it difficult for him to distinguish between guilt, shame, and embarrassment. Although he distinguished between the self-conscious versus primary emotions by the introduction of "thoughts about," his desire to demonstrate continuity in emotional life between humans and animals made it difficult for him to develop these ideas further. His use of the blushing response was his attempt to explore these new emotions in terms of his idea of the evolution of action patterns. For example, his observations of his son lead him to believe that these early action patterns were innate and evolutionarily derived: "…of the various expressions which he exhibited, for I felt convinced, even at this early period, that the most complex and fine shades of expression must all have had a gradual and natural origin" (Darwin, 1887/1993, pp. 131–132). This was his attempt to relate emotions seen in facial, bodily, and vocal expressions in both animals and humans. However, once he turned to the self-conscious emotions, the only possible connection he could use was the bodily response of blushing, even though the elicitor of such responses was complex thoughts about the self and what the self thought about others' thoughts about one's self.

He had some idea in regard to the emergence of a self (an objective self in James' terms, or the idea of me in my terms) and used the child's mirror recognition as a measure, again anticipating our own work on this topic (Lewis & Brooks-Gunn, 1979). His interest in the emergence of self was related to when he thought children came to recognize themselves in mirrors. Here, Darwin was somewhat misled by his observations, for while even infants show interest in looking at their image in the mirrors, the interest in mirrors prior to the middle of the second year of life is mostly due to interest they, as well as adults, have for infant faces in general. Infants, like children and adults, are captivated by and show great interest in images of any infant and very young child. This interest in babyishness can be seen across species and does not reflect self-recognition but reflects interest in looking at images of babies. In most of our work on self-recognition in mirrors, we use self-directed behavior toward a mark on their nose rather than

their behavior in mirrors. Using mark-directed behavior, no children show self-directed behavior prior to 15 months of age (Lewis & Brooks-Gunn, 1979; Lewis & Ramsay, 2004a).

Although he was also interested in lying, he could not relate it to the development of self attention or a self system as we have (Lewis, 1993, 2014). As I have written (Lewis, 2014), lying requires that the child have a theory of mind, what can be considered an objective self, as well as knowledge about what the liar knows about what others know, and about how to behave when telling the lie. All of these skills require a theory of mind (Leslie, 1987; Lewis, 2014) and, as Harris and Gross (1988) and Talwar and Lee (2008) have shown, are highly related to lying.

Darwin's interest in the emergence of self and, more particularly, self attention, can be seen in his work on blushing. In trying to understand the blushing response, Darwin wrote, "The nature of the mental states which induce blushing. — These consist of shyness, shame, and modesty; the essential element in all being self-attention" (1872/1965, p. 325). He goes on to say:

> Many reasons can be assigned for believing that originally self-attention directed to personal appearance, in relation to the opinion of others, was the exciting cause; the same effect being subsequently produced, through the force of association, by self-attention in relation to moral conduct. It is not the simple act of reflecting on our own appearance, but the thinking what others think of us, which excites a blush. (1872/1965, p.325)

With these words, Darwin demonstrated an understanding of an important element in self-conscious emotions. He states two things, first that shyness, shame, and modesty are mental states which induce blushing, making no distinction between them but arguing that the essential element of blushing is self-attention. The second point he makes is that while there is development in emotional life, he does not specify a clear time frame, although he suggests one comes before the other. While the initial cause of blushing is self-appearance in relation to the opinion of others, the second reason, occurring later in development, has to do with the self's action, namely, its moral behavior, or the child's violating particular social values. This is particularly interesting since we have proposed a similar development of the earlier self-conscious emotion of embarrassment (Lewis, 1995a). This argument, considered below, distinguishes between exposure embarrassment and evaluative embarrassment, the first just having to do with being the object of another's attention, while the latter is related to transgressions of moral standards and rules.

As has been pointed out (Lewis, 2014), Darwin even saw the relation between praise and blushing. He writes, "But undoubtedly praise and admiration are highly efficient [that is, in causing a blush]: a pretty girl blushes when a man gazes intently at her, though she may know perfectly well that he is not depreciating her" (1872/1965, p. 325). Thus, praise causes self-attention rather than fault: "Many children, as well as old and sensitive persons blush, when they are much praised. Hereafter the question will be discussed, how it has arisen that the consciousness that others are attending to our personal appearance should have led to the capillaries, especially those of the face, instantly becoming filled with blood" (1872/1965, pp. 325–326).

> My reasons for believing that attention directed to personal appearance, and *not* (italics added) to moral conduct, has been the fundamental element in the acquirement of the habit of blushing, will now be given. They are separately light, but combined possess, as it appears to me, considerable weight. It is notorious that nothing makes a shy person blush so much as any remark, however slight, on his personal appearance. One cannot notice even the dress of a woman much given to blushing, without causing her face to crimson. It is sufficient to stare hard at some persons to make them, as Coleridge remarks, blush. (1872/1965, p. 326)

Again, Darwin makes quite clear that blushing has to do with how others respond to us. Moreover, he has considered embarrassment as measured by blushing to have two features: appearance and moral conduct.

Two Kinds of Embarrassment

In a series of experiments (Lewis, 1995a, 2016a; Lewis, Stanger, Sullivan, & Barone, 1991; Lewis, Sullivan, Stanger, & Weiss, 1989), we have

shown that there are two kinds of embarrassment, one which we call self-exposure embarrassment and the other which we call self-evaluative embarrassment. The former emerges at the same time as does self-recognition and other measures of self-representation, somewhere between 15 and 24 months, while the latter emerges almost a year later, toward the end of the second year of life. In self-exposure embarrassment, the embarrassment is caused simply by being the object of others' attention, and we have found that complimenting, pointing to, and any behavior by others which causes the child to pay attention to itself, induces this response (Lewis, 1995a, 2016a; Lewis et al., 1991, 1989). While Darwin used blushing as a measure of embarrassment, it has its limitations, since not all children blush. More sophisticated measures of embarrassment, including smiling behavior, head gaze (both looking toward and looking away), and actions such as touching one's body, have been developed (Lewis, 1995; Lewis, 2016a; Lewis et al., 1991; Lewis et al., 1989). This self-exposure embarrassment arises early, indeed arises simultaneously with the emergence of a mental state/representation of self. The second embarrassment which Darwin talks about in terms of moral behavior is what we have called self-evaluation embarrassment; that is, it is embarrassment caused by evaluating oneself for failing some kind of standard, rule, or goal (SRG). Embarrassment not only is related to moral failure, as in right in wrong, but also occurs, for example, in achievement tasks where the child fails a goal related to solving a problem.

Some have considered this form of embarrassment similar to shame, but it is certainly less intense and its measurements of both body behavior and facial expression are quite different from that when measuring shame (Lewis, 1992a). Self-evaluative embarrassment as failure of SRGs emerges later than embarrassment of exposure. The distinction between the two is most evident in the embarrassment related to praise which occurs earlier than the other type of embarrassment. The later embarrassment is added to the earlier one, so that by 3 years of age, both are present.

Darwin's consideration of the various types of self-conscious emotions and individual differences is also of some interest, especially as we move from using blushing as a measure. This is especially so when looking at group differences in embarrassment. Our work on other measures of the differences in self-conscious emotions allows us to look at cultural differences not dependent on blushing (Lewis, Takai-Kawakami, Kawakami, & Sullivan, 2010). Although not explored in any detail, Darwin suggested individual differences in shyness as a temperament-like variable that was also influenced by socialization differences:

> As shyness apparently depends on self-attention, we can perceive how right are those who maintain that reprehending children for shyness, instead of doing them any good, does much harm, as it calls their attention still more closely to themselves. It has been well urged that, 'nothing hurts young people more than to be watched continually about their feelings, to have their countenances scrutinized, and the degrees of their sensibility measured by the surveying eye of the unmerciful spectator'. Under the constraint of such examinations they can think of nothing but that they are looked at, and feel nothing but shame or apprehension. (1872/1965, p. 331)

Darwin's observations could have led to a theory around the development of the later, more complex emotions called the self-conscious emotions. Why he did not do so is not clear. Part of this problem was to show how these emotions evolved. This was easier for the early emotions where he could find analogous behaviors in animals. For Darwin, emotional development in humans had the same evolutionary history as other characteristics found in the biological world. Since Darwin's theory required a gradual change brought on by the adaptive advantage of some differences over others, he had to find a connection between animal and human behavior. Darwin's problem as he thought about the self-conscious emotions had to do with the very term self-attention. The idea of self-attention implies a self, a certain level of cognition about the self, others, and the relation between the self and others. Moreover, it involves an understanding of societal standards, rules, and goals. While Darwin

appeared to recognize this need, he was confronted with the difficulty of explaining how these adult human skills emerged and differed from those of young children and animals. Darwin used observation of the great apes to provide some information on possible continuity between animals and humans. Nevertheless, leaps into moral behavior around standards unique to humans would have been difficult for Darwin to make, and remained so, under his idea of gradualism. Without such an explanation, Darwin's own analysis of emotional life and development was limited. Darwin did consider briefly the idea that mentally defected people might represent the missing link, but did not pursue it since he also had to consider that people of color could also represent a missing link—a prejudice common at the time of his writing. It must be recalled that Darwin's whole discussion of the self-conscious emotions has to do with his interest in the phenomenon of blushing, which we have said does not occur in any other species but humans. If there is this discontinuity in intellectual life between humans, perhaps some great apes, and the rest of the biological world, then emotions which are dependent upon this intellectual capacity should be possible in humans, and possibly great apes. This uniqueness must have been difficult for Darwin to accommodate. Perhaps focusing on the behavior of blushing rather than on the mental operations themselves suited his theoretical needs.

Darwin, in his consideration of self-reflection and the self-conscious emotions, has not been fully appreciated. His interest in the earlier emotions is best known, and his descriptions of these emotions were formalized into the measurement of emotions on the face by Izard (1977, 1979) and Ekman (Ekman & Friesen, 1975, 1978). His work on the self-conscious emotions, and especially his work on self-attention, remained underappreciated until more recently (see H.B. Lewis, 1971; Lewis & Brooks-Gunn, 1979; Lewis & Michalson, 1983; Tomkins, 1963). The limitation of Darwin's ideas on self-conscious emotions is likely due to a complex set of factors, not the least of which was his own struggle to eliminate the idea that humans held some unique and therefore godlike position in the biological world. So too was the emphasis on the measure of the face as the seat of all emotions including shame, which, from Darwin's own view, was not possible in infancy.

The Self-Conscious Emotions

Study of the development of self-conscious emotions remains limited in spite of the work on the development of the emotions of sadness, fear, joy, anger, and disgust. There are many reasons for this neglect, but the main one is that there are no clear, specific elicitors of these particular emotions. Whereas happiness can be elicited by seeing a significant other, and fear may be elicited by the approach of a stranger, there are few specific situations that always will elicit shame, pride, guilt, or embarrassment. These self-conscious emotions are likely to require classes of events that can only be identified by the individuals themselves. Consider pride. What kinds of elicitors are necessary for pride to take place? Pride requires a large number of factors, all having to do with attributions and cognitions related to the self. Pride occurs when one makes a comparison or evaluates one's behavior vis-à-vis some standard, rule, or goal (SRG) and finds that one has succeeded. Shame or guilt, on the other hand, occurs when such an evaluation leads to the conclusion that one has failed.

The elicitation of self-conscious emotions involves elaborate cognitive processes that have, at their heart, the notion of self. Although some theories—psychoanalysis, for example (see Erikson, 1950Freud, 1936/1963)—have argued for some universal elicitors of shame, such as failure at toilet training or exposure of the backside, the idea of an automatic, noncognitive elicitor of these emotions does not seem likely. Cognitive processes must be the elicitors of these complex emotions (Lewis, 1992b). It is the way we think or what we think about that becomes the elicitor of pride, shame, guilt, or embarrassment. There may be a one-to-one correspondence between thinking certain thoughts and the occurrence of a particular emotion; however, in the

case of this class of emotions, the elicitor is mostly a cognitive event. This does not mean that the earlier emotions, those called "primary" or "basic," are elicited by noncognitive events. Cognitive factors may play a role in the elicitation of any emotion; however, the nature of the cognitive events is much less articulated and differentiated in the earlier ones (Plutchik, 1980). As already mentioned, the understanding of the development of these emotions requires that we need to consider the role of self-reflection.

The distinguishing between emotions such as embarrassment, shame, guilt, and shyness remains a problem. Considering the classical psychoanalytic literature, more attention was given to guilt rather than shame, although Freud's (1936/1953) two types of guilt appear to mark the differences between guilt and shame; shame he said relatively little about.

For Freud, in guilt the superego—the mechanism by which the standards of the parents are incorporated into the self, specifically via the child's fear that the parents will respond to transgression by withdrawal of love or even by punishment—is the initial source of the feeling of guilt. Freud's discussion of guilt in relationship to the superego is similar to his discussion of guilt in relation to the instinctual drives and their expression. For Freud, anxiety or fear is translatable directly into guilt. The two stages in the development of the sense of guilt related to the superego are (1) the fear of authority and (2) the fear of the superego itself, once the authority standards are incorporated. In the well-developed superego, the sense of guilt arises not only when a violation is committed, but even when a violation is being anticipated.

The guilt that Freud focuses on is not a guilt related to the whole self but a specific and focused response to a transgression that can be rectified by abstinence and penance. When Freud did mention shame, he usually did so in the context of drives and impulses that require restriction.

Erikson, in discussing shame, had no more success in distinguishing between shame and guilt, but like Darwin suggested that shame arises when "one is completely exposed and conscious of being looked at, in a word, self-conscious" (1950, pp. 223–224). Again, this self-consciousness is an undifferentiated state of being—that is, shame, shyness, embarrassment, and guilt—although Erikson tried to differentiate these emotions, for example, "visual shame" versus "auditory guilt." Although Erikson held to a more interactional view, one involving self and self-consciousness, he also indicated that the conditions necessary for feeling shame include being in an upright and exposed position. As he stated, "Clinical observation leads me to believe that shame has much to do with a consciousness of having a front and a back, especially a 'behind'" (Erikson, 1950, pp. 223–224). Erikson believed that shame is related to specific body acts, in particular toilet functions, and his theory of ego challenges suggests his best differentiation between shame and guilt. In Erikson's second challenge, autonomy versus shame and doubt arises. Autonomy is the attempt of the child to achieve, to do for himself or herself—an attempt that is related to a developing sense of the self. Achieving muscular control, including control of the elimination of body waste, is the socialization and the developmental challenge at this life stage. Shame and doubt arise during this stage as the counterpoints to autonomy, the successful achievement. In other words, shame and doubt arise from the child's inability to fully control bodily functions. It is only after this basic ego task that the third ego task, initiative versus guilt, becomes significant. Here Erikson suggested that guilt has a reparative function. Erikson's developmental sequence indicates a recognition that shame and guilt are different emotions—that shame precedes guilt and that they are associated with different ego tasks.

Alternative theories having to do with self psychology have been more successful in differentiating shame from guilt (H.B. Lewis, 1971). Success or failure vis-à-vis our standards, rules, and goals (SRGs) is likely to produce a signal to the self that results in self-reflection (see Mandler, 1975, for a discussion of events likely to cause self-reflection). This cognitive reflective process gives rise to self-attribution and to the specific emotions that accompany the different types of self-attribution. The importance of such a view

resides in three factors. First, the model does not attempt to specify what constitutes success or failure, or how the person goes about evaluating success or failure. Second, the model does not specify any particular SRG. In other words, it is not clear whether there are any specific stimuli that uniquely contribute to any of the self-conscious emotions. Third, the model assumes that self-attributions leading to specific emotions are internal events that reside in people themselves, although the SRGs are taught by others.

Self-Conscious Exposed Emotions

While elaborate attributional processes including self-reflection and socialization cognitions about standards, rules, and goals (SRGs) are necessary for the self-conscious evaluative emotions, there is a class of self-conscious emotions that occurs after the rise of self-consciousness, called self-conscious-exposed emotions (Lewis, 2014). They are not related to the cognitive-attributional processes that occur for the evaluative emotions such as shame or pride. When consciousness emerges, emotions related to attending to oneself become possible. Emotions that require this cognitive capacity, but not self-evaluation, constitute this class of self-conscious emotions. For example, *embarrassment* emerges and can be seen as early as 15 months. However, there are two forms of embarrassment: exposure and evaluative embarrassment (Lewis, 1995a; Lewis & Ramsay, 2002). Exposure embarrassment emerges first, while evaluative embarrassment appears later. Exposure embarrassment occurs only after self-recognition and appears in contexts characterized by being the object of others' attention (Lewis et al., 1991, 1989). We (Lewis et al., 1991) have shown that being praised lavishly, pointed at, or asked to perform for others all elicit exposure embarrassment provided that self-recognition has emerged. These early self-conscious emotions are embarrassment, empathy, and envy (jealousy). Let us briefly examine each.

Embarrassment

Embarrassment and shyness are frequently confused. Some consider shyness to be sheepishness, bashfulness, uneasiness, or psychological discomfort in social situations. According to this definition, shyness is related to fear and is a non-evaluative emotion precipitated by an individual's discomfort with others. Such a description fits Buss's (1980) notion of shyness as an emotional response elicited by experiences of novelty or conspicuousness. For Buss (1980), shyness and fear are closely related and represent fear of others.

This approach to shyness seems reasonable because it fits with other notions relating the self to others, or what we might call the "social self." Eysenck (1954) has characterized people as social or asocial by genetic disposition, and Kagan, Reznick, and Snidman (1988) have pointed out the physiological responses of children they call "inhibited." Inhibited children are withdrawn, are uncomfortable in social situations, and appear fearful. Shyness may be a dispositional factor not related to self-evaluation. Rather, it may simply be the discomfort of being in the company of other social objects; in other words, it is the opposite of sociability (Lewis, 2014).

If shyness does not seem to rely on self-evaluation, embarrassment often does. It is important, however, to distinguish among types of embarrassment. Sometimes, the self-consciousness of shyness can lead a person to become embarrassed (Buss, 1980). In certain situations of exposure, people become embarrassed, but this is not related to negative evaluation. Perhaps the best example of this is the case of a compliment. A speaker might feel embarrassed after a particularly flattering introduction. Surprisingly, praise, rather than the displeasure resulting from negative evaluation, elicits such embarrassment.

Another example of this type of embarrassment can be seen in people's reactions to public display. When people observe someone looking at them, they are apt to become self-conscious,

look away, and touch or adjust their bodies. In few cases, do the observed people look sad; if anything, they appear pleased by the attention of others. The combination of a briefly averted gaze and nervous touching characterizes the first type of embarrassment.

A related example of embarrassment from exposure demonstrates that embarrassment can be elicited just by exposure—in an experiment when lecturing, I announce that I am going to randomly point to a student and show that pointing is random and does not reflect a judgment about the person by closing my eyes, turning around several times, and pointing. The pointing at a person and the other students looking at the one pointed to invariably elicit embarrassment in the student selected, even though the student has done nothing, good or bad, to deserve attention and has been chosen at random.

In each of these examples, there is no negative evaluation of the self in regard to standards, rules, and goals. Nevertheless, work with children has shown that a sense of self is a prerequisite for feeling embarrassment (Lewis et al., 1989). In these situations, it is difficult to imagine embarrassment as related to shame. Since praise cannot readily lead to an evaluation of failure, it is likely that embarrassment resulting from compliments, from being looked at, and from being pointed to, has more to do with the exposure of the self than with evaluation.

In contrast, a second type of embarrassment is closely related to shame and is therefore dependent on self-evaluation. For Izard (1977) and Tomkins (1963), embarrassment is distinguished from shame by the intensity of the latter. Whereas shame appears to be strong and disruptive, embarrassment is clearly less intense and does not involve disruption of thought and language. Furthermore, people who are embarrassed do not assume the posture of someone wishing to hide, disappear, or die. In fact, their bodies reflect an ambivalent approach and avoidance posture. An embarrassed person alternatively looks at people and then looks away, smiling all the while. In contrast, the shamed person rarely smiles while averting his or her gaze. Thus, from a behavioral point of view, shame and embarrassment appear to be different.

The difference in intensity can probably be attributed to the nature of the failed standard, rule, or goal. Some standards are more or less associated with the core of self; for one person, failure at driving a car is less important than failing to help someone. Failures associated with less important and less central standards, rules, and goals result in embarrassment rather than shame.

Empathy

Empathy can be considered both as an emotion, like sympathy, and a cognition—it would seem to involve the ability to place oneself in the role of another. This ability implies a self and the ability to consider "how I would feel if I were she." In early infancy it may be confused with contamination; for example, Hoffman's observation that infants in a newborn nursery are likely to cry if another newborn cries (Sagi & Hoffman, 1976) or Zahn-Waxler's demonstration that toddlers comfort their mothers when they show distress (Roth-Hanania, Davidov, & Zahn-Waxler, 2011).

Although some claim a form of mentalism for these coordinated emotional action patterns between the baby and the adult, it seems more likely that this coordination reflects *contagion* as a basic biological necessity of all animals that live with conspecifics (see also Ruffman, Lorimer, & Scarf, 2017). It may even involve the use of motor neurons. It does not involve mentalism, although, as for other action patterns, it may become the material from which mentalism is formed. The simultaneity of action between two people through contagion may be the material out of which adult empathy grows. However, in the mature form of empathy, one does not have to be in the presence of the other's distress to feel upset since it is a mental act that does not need the presence of the other's emotional action pattern to produce one's own action pattern.

This, of course, is the problem of much of the research on early empathy. For example, in many studies, the mother pretends that she has pricked her finger on a pin and makes a hurt, sad face and groans in front of the toddler. It is difficult to know whether the toddler's response is caused by contagion or is caused by modeling and learning

to comfort another who is showing pain. Indeed, infants often try to comfort their mothers by patting them or hugging them, but at the same time, they do not look distressed and may even show a happy-like face. It is necessary to separate out contagion or imitation from empathy around distress in order to see its relation to the emergence of consciousness. Although the studies of empathy are limited, Bischof-Kohler (1991) demonstrated that empathy around the distress of another represents neither imitation nor contagion *if* the child's behavior is well organized so that both facial expression and behavior are in accord. She was able to show that this occurs only once the child showed self-recognition behaviors. In other words, mentalism is associated with true empathy while its earlier forms are likely to be contagious action patterns. As Frans de Waal (Preston & de Waal, 2002) has pointed out, elaborate, empathy-like responses certainly can be seen early in the child's life, but the adult human form of the behavior is unlikely to emerge until the development of consciousness.

Jealousy

Jealousy usually arises from the loss of something valuable to another and is most often used when talking about the child as being jealous about the attention or time his mother spends with another, not with him. To be sure, jealousy and envy are often confused and used interchangeably; however, envy refers more to wanting something another possesses. In the case of the child and her mother, the child could be both jealous of the time her mother spends with her sibling and envious of the sibling for being the focus of their mother's attention. As can be seen from this example, these two ideas are not at all clear or distinct, which accounts for their mixed usage. Whether we use the term "jealousy" or "envy," implied in these emotions is a self-referent, the "I" that wants something it does not have. Thus, for these emotions to emerge, consciousness is required. Other cognitive capacities may also be needed; however, jealousy over a mother's attention turned elsewhere, say to a sibling, does not require elaborate cognitions since the direction of another's attention is readily discriminable (Hart & Legerstee, 2010).

Hart's (2010) work is a good example of the studies exploring this emotion. In one of her studies, infants and their mothers play together, and then on signal the mother turns away from her infant and for a few minutes, while ignoring her, attends to and talks to a doll. The 4-month-old infants show such behavior as interest, joy, anger, and sadness as well as intense negative emotionality to their mother's attention to the doll. Infants showed increases in their emotionality and did so more when their mothers expressed more positive than neutral vocal behaviors toward the doll. Such findings were taken to indicate that infants this young show jealousy. However, whether these behaviors reflect jealousy or protest around the loss of the mother's attention is not clear, although I would think protest is more likely.

In studying infants, a child's protest over loss of the attention of others generally has been considered in two ways, either as the departure of the mother, as in the attachment paradigm in which the mother leaves the child alone in a strange room, or when the mother is present but is separated from her child either by a physical barrier or by her not directly attending toward the child, as in the still face paradigm (Ainsworth & Bell, 1970; Lewis & Ramsay, 2005; Weinberg & Tronick, 1996).

In the attachment paradigm, the loss of the mother most often results in protests of sadness and crying, as well as anger, as actions designed to get the mother back (Weinraub & Lewis, 1977). The same behaviors can be seen in situations where the mother is separated from the infant by a see-through barrier. While the 1- and 2-year-olds in the experiments can see their mothers, they cannot get close to them. The behaviors of crying, looking at the mother, and trying to get over the barrier are exhibited (Feiring & Lewis, 1979; Goldberg & Lewis, 1969; Wasserman & Lewis, 1985). The same can be said for the infant's behavior when the mother turns away from her interaction with the child (Lewis & Ramsay, 2004b; Tronick, Als, Adamson, Wise, & Brazelton, 1978). Looking at a very young infant's response to the frustration of a blocked goal in its object world also shows these same behaviors. Thus, in situations involving the loss of the mother's attention, measured

by her nonavailability as when behind a barrier, or by her complete disappearance as in the attachment paradigm, or by her lack of interaction as in the still-face procedure, there are similar infant responses, namely, protest. To call these behaviors "jealousy" seems premature, unless one wishes to attribute mental status to the infant's behavior. Although many would, there is no reason to do so unless one is caught in anthropomorphizing about how the adult would feel in the context of one's loss of one's mother (Bradley, 2010; Hobson, 2010; Keller & Lamm, 2010; Trevarthen & Aitken, 2001).

Self-Conscious Evaluative Emotions

The second class of self-conscious emotions emerges around ages 24 to 30 months. These later emerging self-conscious emotions require a more elaborate set of cognitive capacities, all of which involve evaluation of one's behavior, thus the name, self-conscious *evaluative* emotions. These emotions require capacities that include the ability to acquire and remember standards, rules, and goals (SRGs), to evaluate one's actions and behavior with reference to them, and to make judgments about personal responsibility for success and failure. This new set of skills has profound implications for not only emotional development but also competence, since these skills provide the emotional backdrop for learning and achievement (Stipek, Recchia, & McClintic, 1992). The capacity to evaluate one's own behavior against a standard gives rise to the self-evaluative emotions, including pride, shame, guilt/regret, and hubris. These emotions serve to motivate children's subsequent behavior, thus promoting further competence. For example, pride motivates the child to work harder to re-experience this emotion. In contrast, shame, guilt, and embarrassment may motivate children to alter their behavior and possibly to become avoidant of people and situations that may elicit this emotion. Because the nature of the child's evaluation is critical to the emotions elicited, consideration of the nature of these processes is necessary.

The self-conscious evaluative emotions require a set of cognitive capacities, including the ability to evaluate one's behavior positively or negatively in regard to learned SRGs, to attribute responsibility for an outcome, and to focus attention on global versus specific aspects of the self. Since we have presented this model previously (e.g., Lewis, 1992a, 2014), I will define each of these evaluative processes briefly, ending with the model of how they are related to these evaluative emotions.

SRGs are the information children acquire about expected behavior through their socialization in a particular society. They will vary even within societies, among families and social groups, across time, and among individuals of different ages. By the second year of life, children show rudimentary understanding about "good" and "bad" behaviors, suggesting that some learning of SRGs has been learned (Heckhausen, 1984; Kagan, 1981; Stipek et al., 1992). SRGs may be learned in many ways, such as observation of others' behavior, or more directly by explicit statements that parents or others make about what they expect of the child in a certain context. When children compare their behavior to a learned standard, rule, or goal, there are two possibilities: success (i.e., positive relative to SRGs) or failure (i.e., negative relative to SRGs). If children evaluate their behavior relative to a standard and find that it equals or exceeds the standard, they judge the behavior as successful. Likewise, if the behavior is less than the standard, children judge their behavior as failing.

Another determination is whether children believe that they are responsible for the success or failure. In the adult attribution literature, perceptions of personal responsibility for events are thought of as either internal or external attributions (Weiner, 1986). Similarly, among young children, internal attributions are those by which the child "owns" and feels responsible, whereas external attributions are those by which the child does not feel responsible. They may explain their failure in terms of the actions of others (Dweck & Leggett, 1988; Seligman et al., 1984).

The child can also focus on whether the outcome is due to global or specific features of the

(1) Standards, Rules, and Goals (SRGs)

(2) Attributions of Responsibility

(3) Self-focus

	Success	Failure
(Performance) Global	Hubris	Shame
(Task) Specific	Pride	Guilt/Regret

Fig. 2 A structural model of four self-conscious evaluative emotions. This figure presents our structural model, identifying the attributions that serve as the elicitor for each of the four self-evaluative emotions (Lewis, 1992a, 2014, 2018)

self (Beck, 1979; Lewis, 1992a). Dweck has referred to this dimension as a motivational disposition of "performance" as opposed to "learning orientation" (Dweck, 2006; Dweck & Leggett, 1988). Global attributions refer to the tendency of an individual to focus on the total, unchanging self when making an evaluative judgment. Thus, for any behavior, some individuals, some of the time, are likely to focus on the self and to make trait-like statement such as, "I did this because I am bad (or good)." On such occasions, the focus of the judgment is on the total self, both as object and subject. This type of total self-focus is particularly intense since it reflects a damaged self. The focus is not on the individual's behavior in a particular place and time (a specific, unstable attribution) but on the self's global worth. In contrast, specific attributions refer to the tendency of some individuals, some of the time, to focus on the particular actions that led to success or failure in that place and time. Specific attributions usually make reference to unstable factors. In this case, it is not the total self that has done something wrong or wonderful; instead, particular behaviors in a particular situation are blamed (Janoff-Bulman, 1979). At such times, individuals will make such statements as, "What I did was wrong, and I must not do it again." The focus in such a statement is on the self's specific behavior with objects or persons and the effect of these actions.

Thus, to express self-evaluative emotions the child must have the ability to evaluate behavior in relation to SRGs, the ability to assume responsibility for success or failure, and to assess whether their success or failure is likely to be due to global, stable aspects of the self, or specific, changeable circumstances. The nature of these judgments is the critical elicitor of self-conscious evaluative emotions (Fig. 2).

The set of cognitions and attributions include knowledge of the SRGs and their incorporation into the cognitive framework of the child; the comparison of one's actions and thoughts relative to the SRGs, leading to success or failure; and the attribution of responsibility for the success or failure, the focus on the self as either the global self (performance) or the specific self (task orientation). These cognitive attribution processes are presented as an ordered sequence of cognitions. It needs to be emphasized that they are not necessarily so linearly ordered. For example, if children choose responsibility for their failure vis-à-vis a set of SRGs, which results in feelings of shame, it is possible for them to reinterpret the situation such that they decide that they were not responsible for the failure. In doing so, they do not feel shamed, as they are able to avoid feeling responsible. In the case where they do not feel responsible, they will not feel shame or guilt since the failure was not caused by them. In fact, they can conclude that another is responsible for

the failure. This is a defensive strategy used by some, and has been related to narcissism (Morrison, 1989). While there are few studies on how these types of recursive attributions might work, some attention has been given to the topic of felt and unfelt shame (H.B. Lewis, 1971; Lewis, 1992a) which presents a similar process, namely, that shame being so adversive, some people solve the problem of this feeling by changing their attributions so as to avoid it. Gold, Sullivan, and Lewis (2011), for example, have demonstrated that when adolescents show shame as the result of taking responsibility for their failure, they show different antisocial behavior from that of children who do not express shame but blame others for their failure. The "felt shamed" adolescents are likely to commit crimes against property, while the "unfelt shamed" adolescents are more likely to commit crimes against people. In the discussion of hubris (see below), the idea of hubris and narcissism as a defense against feeling shame is addressed. Defensive behaviors against shame use cognitive and attributional processes in a nonlinear path to avoid feeling shame.

Shame

Shame, like all the self-conscious emotions, is not learned. It is an action pattern and is the consequence of a specific set of complex ideas about the self. The phenomenological experience of the child having shame is one of extreme pain and is highly negative. It is a wish to hide, disappear, or die. It is a broken self and is accompanied by increases in the stress hormone cortisol (Gruenewald, Kemeny, Aziz, & Fahey, 2004; Lewis & Ramsay, 2002). This experience of shame results in the disruption of ongoing behavior, confusion in thought, and an inability to speak. The action pattern of shame includes a shrinking of the body, a collapse of the shoulders and head—part of the feeling of wanting to disappear from oneself or others. It is a normal reaction to the accompanying cognitive processes and attributions. The pathology of shame is in the extremes, too little or too much shame. Certainly, its role appears to be one of inhibiting the action and thoughts which lead to it. Because of the intensity of the negative feeling about the self—a broken self—this feeling is difficult to dissipate. A variety of cognitive and attribution strategies including forgetting, confession, and conversion reinterpretation are used to cope with the feeling (H.B. Lewis, 1971; Lewis, 1992a). Shame can occur both publicly and privately, unlike embarrassment which is usually public.

Guilt

The emotional state of guilt or regret is produced when individuals evaluate their behavior as failure but focus on the specific features or actions of the self that led to the failure. Unlike the focus in shame on the global self, the focus in guilt is on the self's actions and behaviors that are likely to repair the failure. From a phenomenological point of view, individuals are pained by their failure, but this pained feeling is directed to the cause of the failure or the object of harm. Because the cognitive-attributional process focuses on the action of the self rather than on the totality of self, the feeling that is produced—guilt—is not as intensely negative as shame and does not lead to confusion and to the loss of action. In fact, the emotion of guilt has always associated with it a corrective action that an individual can take (but does not necessarily take) to repair the failure. Rectification of the failure and preventing it from occurring again are the two possible corrective paths. Whereas in shame we see the body hunched over itself in an attempt to hide and disappear, in guilt we see individuals moving in space as if trying to repair their action (Barrett & Zahn-Waxler, 1987; Cole, Barrett, & Zahn-Waxler, 1992). The marked postural differences that accompany guilt and shame are helpful both in distinguishing these emotions and in measuring individual differences. We might point to blushing as a measure also distinguishing guilt from shame; however, because of the variability in the likelihood of individuals to blush, the use of blushing is not an accurate index.

Because in guilt the focus is on the specific, individuals are capable of ridding themselves of this emotion through action. *The corrective action can be directed toward the self as well as toward the other; thus, unlike shame, which is a*

melding of the self as subject and object, in guilt the self is differentiated from the object. As such, the emotion is less intense and more capable of dissipation. Moreover, it should be unrelated to maladaptive behavior. The problem is that guilt may merge into shame; thus, two types of guilt might be considered, guilt and maladaptive guilt. The expectation would be that guilt would not be correlated with shame while maladaptive guilt would be (Tangney & Dearing, 2002), which has not turned out to be the case (Tangney, Ferguson, Wagner, Crowley, & Gramzow, 1996). Thus, should the corrective action not be forthcoming—in either thought, feeling, or deed—it is possible that a guilt experience can be converted into one of shame (H. B. Lewis, 1971). Again, the nonlinearity of attribution and feeling is likely where reinterpretation can result in different feelings. Rather than linearity, it might be necessary to think of the cognitive-emotional process more like a fugue (Lewis, Sullivan, & Michalson, 1984). It seems that the difference between them in regard to these reinterpretations of attributions and feelings is that we can be ashamed of our guilty action, but we cannot be guilty over being ashamed. Besides reinterpretation, the emotion of guilt would seem to be less intense than shame. It is not self destroying and as such can be viewed as a more useful emotion in motivating specific and corrective action. However, because it is less intense, it may not convey the powerful motivation necessary for correction.

Pride

Pride is the consequence of a successful evaluation of a specific action. The phenomenological experience is joy over an action, thought, or feeling well done. Here, the focus of pleasure is specific and related to a particular behavior. Some have likened this state to achievement motivation (Dweck, 1996; Heckhausen, 1984; Stipek et al., 1992). In pride, the self and object are separated, as in guilt (see Tracy & Robins, 2004). Unlike shame, where subject and object are fused, pride occurs when people focus on their actions; the person is engrossed in the specific actions that give them pride. Because this positive state is associated with a particular action, individuals have available the means by which they can reproduce the state. Notice that pride's specific focus allows for action. The study of pride, like other self-conscious emotions, has been understudied, although Tracy, Robins, and Lagattuta (2005) have shown that the recognition of the expressions of pride can be seen early and has a set of specific behavioral markers (also see Lewis & Sullivan, 2005; Tracy & Robins, 2004).

Hubris

We can agree that pride and hubris seem somewhat different. Pride is associated with a job well done, a good and positive response to meeting the SRGs of others and of the self. Hubris, on the other hand, seems like overblown pride and is considered socially inappropriate, as in a pride "that goeth before the fall." These two types of pride are the result of the attributions associated with success vis-à-vis SRGs. In pride, the focus of the attribution is associated with the specific focus on the task which one has succeeded in, while in hubris, it is on the global self, a focus on one's performance rather than the task. It is the difference between "I succeeded in…" and "I am a good person."

The difference between pride and hubris has been explored by Tracy and Robins (2007), and they found that children are able to distinguish between them, although less on differences in expression. Hubris appears as a more "puffed up" bodily expression than pride. Hubris has social repercussions since it is likely to interfere with the wishes, needs, and desires of others. There is also evidence that too much praise of children, and their resulting self-focus, can lead to negative performance (Baumeister, Campbell, Kreuger, & Vohs, 2003; Gunderson, Gripshover, Romero, & Dweck, 2013; Haimovitz & Corpus, 2011; Kamins & Dweck, 1999; Mueller & Dweck, 1998).

The problems associated with hubris are that it is a transient but addictive emotion; but it is not related to action but to self deception and therefore requires continually altering goals or reinterpreting what the person considers successful. This also interferes with interpersonal relationships because of its insolent and contemptuous nature.

Like all emotions, the major problem lies in having too little or too much. Having too much hubris leads us into a consideration of narcissism. Narcissism is an exaggerated or persistent hubris. Hubris as a narcissistic disorder arises as a defense against shame (Lewis, 1992a, 2018; Morrison, 1989). There are several thoughts on the relationship between shame and narcissism which have suggested that shame is the underside of narcissism (Lewis, 1992a; Morrison, 1989). We need, therefore, to consider shame and its meaning. The preschool child, like the adult, acquires a set of standards, rules, and goals (SRGs)—a simpler set in childhood and a more complex set in adulthood. Shame is produced when one evaluates failure in one's SRGs and determines that one is responsible for that failure, attributions resulting in a broken self. Since shame is a global attack on the self, there are usually difficulties in dissipating it. Specific actions that one can employ not to feel shame include forgetting, reinterpretation of attributions that lead to the shame, confession, and laughter (H.B. Lewis, 1971; Lewis, 1992a; Stipek et al., 1992).

It is too much shame which is at the heart of shame's relationship to narcissism. Narcissism is caused by an over self-focus or attention and early-in-life failures (Lewis, 2018; Morrison, 1989). Such a combination leads to shame. One defense against the ensuing shame is the utilization of self-attributions that lead to an avoidance of shame. In our attributional model, these attributions or reinterpretations can focus on lowering of one's SRGs, to reinterpret a failure as a success, and to reinterpret responsibility either as not being responsible—it was not my fault—or to blame others for the failure (Lewis, 1992a, 2018). These defensive attributions are useful in avoiding failure by altering one's SRGs. For example, if not getting an A in a chemistry class produces shame, one can reinterpret the failure by coming to believe that a C is good enough. Alternatively, one can also alter the responsibility for getting a C by blaming others for the failure; for example, there was too much noise for me to study properly, or by blaming others as in the teacher gave too hard an exam. These characteristics can be seen as the ways shame is avoided: lowering standards, rules, and goals so as to make one's behavior a success, not a failure; blaming others for failure; and overestimation of one's achievement. Given the connection between shame and narcissism, the hypothesis offered here is that increases in self-focus lead to increases in shame, which in turn leads to increases in narcissism to avoid the shame about the self. Unfortunately, narcissism leads to self-focus and therefore a circle-like condition. Increases in self-focus and parenting practices are likely to lead to increases in shame and therefore to narcissism (Lewis, 2018).

Testing the Theory: Self-Consciousness and the Emergence of Emotional Life

The theory proposed has its roots in the empirical research I and my colleagues have undertaken. The theory both informs and is informed by the findings reported here. Because there was little work on the development of the self-conscious emotions as described, and given their emergence in the first 2 years of life, it was necessary to invent measures and paradigms which could be used. Building on the work and measures of Darwin and of those who followed him, we were able to both invent and refine the work of others in order to uncover the early stage of the development of the self-conscious emotions. Most of the work involves children from 2 to 7 years, as well as our work with adolescents, especially those who had experienced early trauma. I focus on our work on embarrassment, both as an exposed emotion and as an evaluative one. We also studied shame, pride, guilt, and hubris, the latter ones more as part of the theory than as empirical observations. The work and scales developed by Tangney are important, but given their use for adults and older children, could only be used on occasion (Tangney et al., 1996; Tangney, Wagner, Burggraf, Gramzow, & Fletcher, 1990).

Embarrassment: The First Self-Conscious-Exposed Emotion

For embarrassment we utilized studies which elicited the child's feeling by being the object of others' attention, as suggested by Darwin (1872/1965). Children were lavishly complimented in an effusive manner. A series of four to five compliments were made about the child's appearance; for example, children were told that they were smart and cute and had beautiful hair and lovely clothes. Overpraise was chosen as an elicitor since it has been shown to elicit blushing and giggling in adults and adolescents (Buss, 1980). They were also requested to dance, and a small tambourine was provided to the mothers and experimenter and used to coax the child to dance.

The behavioral criteria for embarrassment were those used by Lewis et al. (1989) based on the descriptions of others (Buss, 1980; Edelman & Hampson, 1979; Geppert, 1986; Modigliani, 1971) and was defined as smiling followed by gaze aversion and action of touching their bodies. Blushing as suggested by Darwin (1872/1965) was not used since it is a low occurring event. The first finding revealed that embarrassment was related to the emergence of self recognition in mirrors, while wariness to the approach of a stranger was not (Lewis et al., 1989). Lewis et al. (1991) in another study found age and sex differences in embarrassment. Fifty-two percent of the 2-year-olds and 82% of the 3-year-olds showed embarrassment on at least one occurrence in both a cross-sectional age and longitudinal analysis. While the situations we used elicited embarrassment, not all children showed embarrassment, which suggested that individual and age differences, besides self recognition in mirrors, affected the child's likelihood of showing embarrassment.

To explore whether *temperament* played a role in the individual differences in children's display of embarrassment, we conducted another study (DiBiase & Lewis, 1997). The revised Infant Temperament Questionnaire (RITQ; Carey & McDevitt, 1978) was used to measure temperament and provided an easy-difficult temperament categorization described by Thomas, Chess, Birch, Hertzig, and Korn (1963) and also Rothbart, Ahadi, and Hershey (1994). Also obtained was whether the children showed self recognition. The findings revealed that for children who did not show self recognition, there were no differences in embarrassment as a function of temperament. However, it appears that once children have the cognitive capacity necessary for the emergence of embarrassment, that is, have self recognition, individual differences in temperament play an important role in an individual child's display of embarrassment (Lewis & Ramsay, 1997).

Self-Conscious Evaluative Emotions

Attributions

By calling these emotions the self-conscious evaluative emotions, I mean to imply that these emotions require further cognitions than self reference. The self-conscious evaluative emotions require capacities that include the ability to acquire and remember standards, rules, and goals (SRGs), to evaluate one's actions and behavior with reference to them, and to make judgments about personal responsibility for success and failure as well as being able to focus attention on global vs specific aspects of the self. The capacity to evaluate one's own behavior against a standard gives rise to the self-evaluative emotions, including pride, shame, and guilt, as well as to social behavior such as empathizing, sharing, and moral action. These emotions serve to motivate children's subsequent behavior, thus promoting further competence. For example, the ability to feel pride motivates the child to work harder to re-experience this emotion. In contrast, shame, guilt, and embarrassment motivate the child to alter his or her behavior and possibly to become avoidant of people and situations that may elicit this emotion. Because the nature of the child's evaluation is critical to the emotion elicited, we must consider the nature of these processes. By the second year of life, children show rudimentary understanding about "good" and "bad" behaviors, suggesting that learning of SRGs is

underway (Heckhausen, 1984; Kagan, 1981; Stipek et al., 1992).

Measuring Task (Specific) and Performance (Global) Attributions

Dweck, Chiu, and Hong (1995) obtained performance orientation by asking children to work on both solvable and unsolvable tasks. Afterward, they assessed their choice to avoid or return to the unsolved task. Children who choose to avoid the unsolved task and choose a task on which they know they have succeeded are considered performance-oriented. Their choice of a "sure success" suggests a motive to avoid "a display of incompetence." We have developed other methods that work well and can be used with children as young as 3 years old to study attributions as well as emotional behavior (Lewis, Alessandri, & Sullivan, 1992).

In our own work, we present children with easy and difficult tasks. "Easy" and "difficult" are defined by the number of pieces in the problem that children are given to work on in a given time period. We could vary whether they succeed or fail on these tasks by manipulating the time they are given to complete them. In this way, children get easy and difficult tasks on which they succeed or fail. After each task, we ask children whether the task was easy or difficult. Our interest is on the "easy task which they fail." Their verbal response of "easy" or "hard" on this task informs us about whether they are making a performance- or a task-based evaluation. If they state that it was "hard" (even though in reality it was easy), they are focusing on their performance, which was a failure. If they say "easy," they are focusing on the task despite their own performance. Thus, the "easy-failed task" presents the child with a discrepancy between what the child expects (to do well when it is easy) and the outcome (failure). The response reveals whether the child focuses attention *globally*, that is, on personal performance, or *specifically* on the level of the task. Our hypothesis is that these judgments in response to the "easy-failed task" should predict other self-related evaluations, as well as the expression of self-conscious evaluative emotions.

Task vs Performance Focus and Their Relation to Other Responses to Failure

If children's task vs performance focus, as measured here, is related to other self-evaluations on achievement tasks, we thought it supported the validity of this new measure. We used a number of methods to test how task- versus performance-focused children viewed failure (see above). To obtain self-evaluations, after each task, we asked children (1) whether they had done "good or not so good," and (2) whether they would be willing to do the task again. Performance-focused children were twice as likely as task-focused children to say that they had not done well (see Fig. 3). We have replicated this result in several studies of 4–6-year-old children. As can be seen, task-focused children were more likely to want to try the task again. Conversely, performance-focused children did not want to try again, replicating Dweck's findings that these children are motivated to avoid failure.

Are these self-reported evaluations related to children's emotions following failure? If performance focus reflects an internalized negative and global focus of attention, we would expect performance-focused children to say they feel unhappy. To assess children's verbal report of their feelings, we used a version of Dweck's Happy Face Scale. The pictorial scale has five schematic faces representing high positive emotion on one end and negative feelings on the other. The size of the smile or inverted U-frown allows children to point out the degree of happiness or unhappiness, ranging from very happy, a little happy, okay, a little unhappy, to very unhappy. We asked the children to rate "how you feel right now" using this scale. The children's self-reports of unhappiness following the "easy-failed task" were related to their performance focus. Children who were performance- as opposed to task-focused were significantly more likely to report greater sadness. Collectively, these findings parallel a number of the features of the performance-oriented motivational style described by Dweck et al. (1995), supporting the view that performance focus is a negative self-evaluation related to global trait-like judgments about the self following failure.

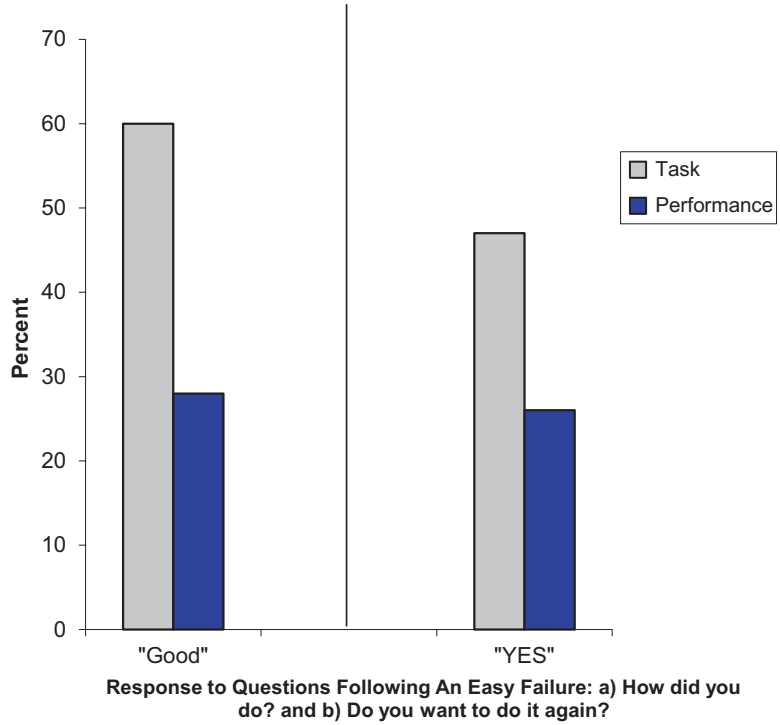

Fig. 3 Children's responses to evaluative questions by task versus performance focus: (a) percentage stating their performance following failure was "good" and (b) percentage of "yes" responses expressing a desire to repeat the failed task

Performance Focus and Self-Conscious Evaluative Emotions

We believe certain self-attributions or self-references lead to certain classes of self-conscious emotions. We have studied preschool children's behavioral expression of emotion following success and failure, relating it to their tendency to be task- or performance-focused. We expected that performance-focused children would show more shame than task-focused children. They also might show more pride following success, although this prediction was more tentative, because it is not possible to distinguish between hubris and more appropriate pride behaviorally at this age (Tracy & Robins, 2007). The effect of performance focus on self-conscious evaluative emotions observed in two studies is shown in Fig. 4. A greater percentage of performance- as opposed to task-focused children showed the negative self-evaluative emotions of shame and evaluative embarrassment following failure in both studies. Performance-focused children also showed more pride following success, especially in Study 2. There was no difference in the percentage or mean level of children expressing joy or sadness in these studies. Collectively, the findings show that performance focus is related to more negative emotions in response to failure and somewhat more positive responses to success than is task focus.

This set of studies indicated that children's task vs performance focus following failure at an "easy task" is related to other evaluative judgments about their personal performance and to their self-conscious evaluative emotions. The consistency of children's answers to simple questions about an "easy-failed task" can be examined to determine the degree to which they focus on the self when thinking about the failure. A performance focus, or attending to performance as opposed to task features following failure, is related to thinking poorly of oneself

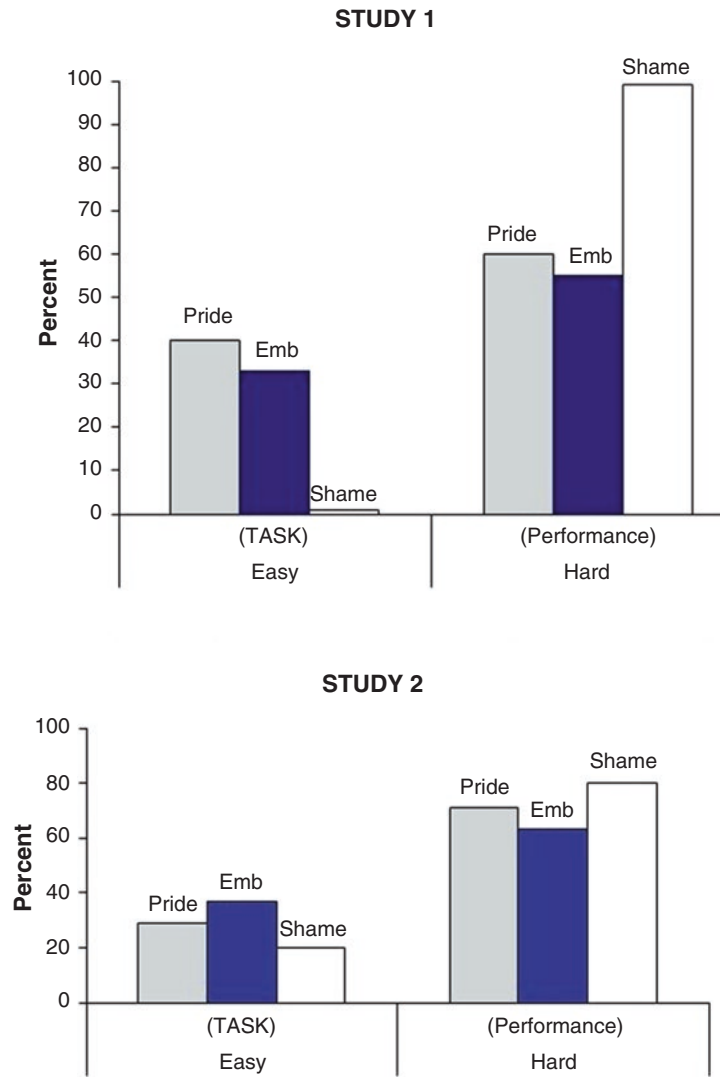

Fig. 4 Self-conscious emotions as a function of task judgments of preschoolers following an "easy failed task" in two studies. The percentage of children showing pride, evaluative embarrassment, and shame is shown for those who said the task was "easy" despite the failure (task focus) and for those who said the task was hard, congruent with their failure (performance focus)

and being unwilling to try again, feeling badly, and to being more likely to show shame and evaluative embarrassment following failure. This pattern of negative self-judgments might represent the early precursors of the internal, stable, global attribution styles observed in older children and adults. Such attribution styles for negative events promote shame, thus constituting a risk factor for subsequent maladjustment.

Shame, Pride, Guilt, Hubris, and Embarrassment

The theoretical underpinnings of these self-conscious emotions require self awareness, *as well as* the cognitions related to standards, rules, and goals (SRGs). It was necessary to create an experimental situation which would capture the expression of these emotions. The use of easy and difficult tasks, and controlling

success and failure, as described above, accomplished our being able to observe these emotions in an experimental situation and, through the use of videotapes, allowed us to capture these fleeting facial and bodily action patterns.

Learning SRGs

The nature of SRGs themselves—and what constitutes success or failure—varies with individuals. Exactly how one comes to evaluate an action, thought, or feeling as a success or a failure is not well understood. Yet this aspect of self-evaluation is particularly important because the same SRG can result in radically different emotions, depending on whether success or failure is perceived and attributed to the self. Differences in SRGs within a societal group and between cultures will occur because groups within a society and different cultures value some SRGs more than others. The initial evaluation of one's behavior in terms of success and failure is also a very important aspect of the organization of plans and the determination of new goals and future expectations of success and failure. Many factors are involved in producing idiosyncratic, unrealistic evaluations of performance relative to SRGs. High standards, however, may not themselves necessarily be bad. Instead, extremes of punishment and the quality of the discipline produce individual differences. Harsh socialization experiences, especially high levels of physical punishment for failure and the use of scorn, humiliation, or contempt as discipline techniques, may also affect the quality of SRGs and how behaviors that meet or violate them are viewed (Gold et al., 2011; Lewis, 1992a).

Measuring Self-Conscious Evaluative Emotions

Children were given tasks, which could be described as easy or difficult versions of the same task; for example, two puzzles, the easy one containing 10 pieces and the difficult one containing over 20 pieces, were labeled as easy and difficult. In most studies, two versions of an easy task and two versions of a difficult task were given. The children were shown a clock and told that they had 2 minutes to complete the task. If they finished before the bell sounded, they had succeeded, and if they did not finish when the bell sounded, they had failed. The hands of the clock and the time could be manipulated so that for the two easy tasks, they succeeded in one and failed in the other. The same was true for the difficult tasks. The order in which the tasks were given was counterbalanced. At least two classes of behavior were coded from the videotapes made during the experimental procedures; pride and shame, as well as guilt and embarrassment.

Lewis, Alessandri, and Sullivan (1992) reported the following results. It presents the measurement of shame and pride as a function of task difficulty. As an adult would expect, more shame should be seen when these 3-year-olds failed an easy task than a difficult one, and likewise more pride was shown when they succeeded a difficult task rather than an easy one. This is what we saw (see Fig. 5).

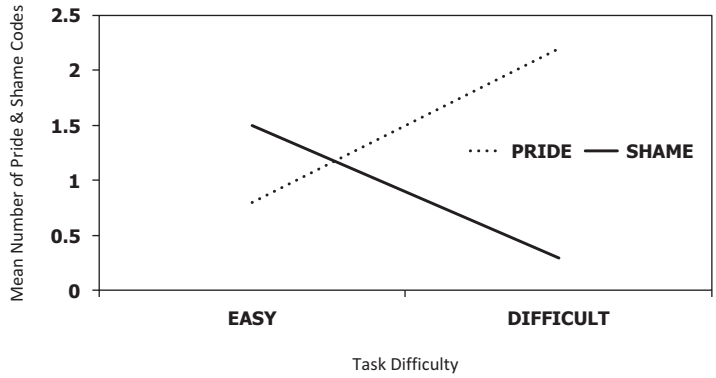

Fig. 5 Incidence of pride and shame as a function of task difficulty

Thus, even by 3 years, these children were capable of making attributions about task difficulty, which suggests that they already had attributions around SRGs and task difficulty. Sex differences also were found. While boys and girls exhibited equal amounts of pride, girls showed significantly more shame than boys.

These findings of gender differences in shame appear consistent with what has been reported in the literature for adults; adult females express more shame than do males (see H. B. Lewis, 1987; Lewis, 1995b; Tangney, 1990). The gender differences in the expression of shame over failure appear to exist early and are found throughout the life course. The causes of this sex difference remain unclear. However, the research on sex differences in achievement expectancy and in self-evaluation has been well documented (Dweck & Leggett, 1988; Parsons, Ruhle, Hodges, & Small, 1976; Stein & Bailey, 1973). Girls generally have lower expectations for success, decreased achievement striving under failure or evaluative pressure, and are more likely to assume personal responsibility for failures than are boys. It has been suggested that particular socialization practices may be responsible for these sex differences in achievement and can be used to explain the sex differences in shame. We suggest that girls are more likely than boys to focus on themselves rather than on their action or what has been called global rather than specific self-evaluation (Weiner, 1986). The focus on a global failure results in shame. One cause that has been identified as producing this global self-evaluation is feedback in the classroom, although it is likely to exist in the socialization practices of parents as well (Dweck, Davidson, Nelson, & Enna, 1978; Dweck & Leggett, 1988; Eccles & Blumefeld, 1985). There is evidence that girls rather than boys receive more negative feedback and that the girls receive more expressive than instrumental or mastery orientation from their parents (Harrington, Block, & Block, 1975; Margolin & Patterson, 1975; Osofsky & O'Connell, 1972).

Parental Socialization and Self-Conscious Evaluative Emotions

To study parental socialization, we examined the evaluations parents make toward their 3-year-old children (Alessandri & Lewis, 1993). Dyadic interactions between each parent and child were videotaped across problem-solving situations. Transcripts were coded into categories of parental behavior, and children's emotional expressions also were scored. We scored several features of parental evaluations, which included *global* and *specific* evaluations, and whether their comments were *positive* or *negative*. Significant type by evaluation effects were found, as well as sex differences. Boys received more positive specific evaluations than girls, while girls received more negative specific evaluations.

We also examined shame and pride self-conscious emotions as they related to parental socialization or evaluations. While the children's pride expressions were not related to either parental specific or global evaluations, shame was. The more positive parental evaluations were related to less shame. This was true for positive specific but not for positive global parental evaluations. In terms of negative parental evaluations, the more negative evaluations—both specific and global—were related to more shame shown by the children. Such findings are suggestive, but clearly, more work needs to be done to relate specific verbal statements of parents and their influence on the evaluations and emotions of children. Moreover, we must recognize that parental facial expressions and other comments are likely also to play a role.

Cultural Differences in Self-Conscious Evaluative Emotions

There also should be cultural differences in emotional responses to success and failure. Cultural influences supporting differences in emotion expressions include a particular world view, as well as sets of specific goals, values, and practices associated with achievement settings. These cultural beliefs and practices are likely to include the teaching of display rules, behaviors, rituals, and contexts which encourage the expression of some

emotions but not others, and possibly the promotion of a differently organized self which filters and interprets emotion states and experiences (Lewis, 1989, 1995a; Markus & Kitayama, 1994).

Japanese socialization strategies have been described in the early anthropological and psychological literature as socializing with shame (Benedict, 1946). However, emotions function in Japan to focus attention away from the self and on the relationship of the self to others. Shame and anxiety are some of the most common negative emotions of cultures socializing interdependency, and Japanese children are socialized to avoid shame as well as to avoid standing out from the group (Kitayama & Markus, 1999). Akiyama (1992) commented that Japanese children are not socialized to monitor, elaborate, or express their personal feelings, so displays of both shame and pride are likely to be discouraged. Instead, they are taught to think about what they did wrong and how to improve their subsequent performance, suggesting a culture focused on guilt, adherence to group standards, and a "learning orientation" in achievement settings (Dweck et al., 1995; Whiting, 1990). Chinese achievement socialization shows a similar pattern. Chinese elementary-age school children report that their mothers de-emphasize academic success and emphasize failure, parenting practices opposite to that reported by their American counterparts (Ng, Pomerantz, & Lam, 2007).

Thus, Japanese children's socialization emphasizes a "we-self" in contrast to the "I-self" of Western societies. Because Japanese children in general are criticized when the group standards are violated, it may be that behavior shameful in a group context might be less shameful when it takes place outside a group setting. For example, Kitayama, Snibbe, Markus, and Suzuki (2004) found that less self-criticism of personal choices was made by Japanese students in the absence of social cues than by Americans for whom such cues made no difference. In two studies of self-reported or imagined responses of a typical student to success and failure, American college students were more likely to engage in self-enhancement compared to Japanese students who engaged in self-criticism (Kitayama, Markus, Matsumoto, & Norasakkunkit, 1997). While these studies did not focus on emotion expression specifically, socialization strategies emphasizing interdependence are likely to have implications for the expression of shame and embarrassment about failure because Japanese children are trained to be especially sensitive and attentive to negative, self-relevant information from the group (Kitayama & Markus, 1999; Markus & Kitayama, 1994). This sensitivity may result in heightened anxiety about evaluation or failure. Japanese students report greater fear of failure (Scherer, Matsumoto, Wallbott, & Kudoh, 1988). East Asian children living in the United States and their native land also rated themselves lower on Harter's scale of children's self-esteem, a finding suggestive of less positive self-regard and possibly pride (Stigler, Smith, & Mao, 1985). More embarrassment also has been reported by Japanese students compared to a European sample (Edelmann & Iwawaki, 1987).

Again using the experimental tasks described earlier, we examined the self-conscious emotions in Japanese, African American, and White European children with regard to self-evaluative emotions. Japanese children were expected to show less pride due to Japanese socialization practices emphasizing group and family rather than personal pride. Because shame expressions typically have been observed in 10–20% of children in previous studies of White and African American children, and because the procedure used in the current study is not explicitly shaming, neither American nor Japanese children were expected to exceed this level (Alessandri & Lewis, 1993; Lewis et al., 1992). If differences were observed, we expected Japanese children to show less shame due to the combined effects of temperament and contextual features. Less shame would be consistent with the temperament view of less expression of negative emotion in young East Asian children. Less shame is also likely because the failure context was designed to foster evaluation of personal performance (an "I-self" evaluation rather than a "we-self" evaluation).

Our hypotheses about embarrassment require that we consider its two distinct forms—evaluative embarrassment during failure and exposure

embarrassment during success (Lewis, 1995a). In American children, evaluative embarrassment occurs in response to failure and is related to shame, negative self-evaluation, and higher cortisol responses to stressful events (Lewis & Ramsay, 2002). In contrast, exposure embarrassment is not associated with a negative self-evaluation or with increased cortisol (therefore, the child is less distressed). It occurs in nonevaluative contexts. Exposure embarrassment can be elicited in nonevaluative contexts such as pointing at the young child, or in response to unsought or unwanted praise or being asked to look at oneself in a mirror while being observed (Lewis, 1995a; Lewis et al., 1991). Miyake and Yamazaki referred to this form as being embarrassed "without recognition that one is inferior," of feeling "childish," or the feeling of "being watched by others" (1995, pp. 490–491). Unlike evaluative embarrassment, which is associated with stress responses, behavioral withdrawal, or avoidance, exposure embarrassment is associated only with being the object of another's attention. Thus, although both forms of embarrassment appear to be mildly negative emotion states marked by similar expressions and gestures, they are physiologically and cognitively distinct and vary in their distribution by context in American children. We expected to observe different patterns in Japanese children. Greater evaluative embarrassment was expected in Japanese children because the children may have greater anxiety following failure, given the greater reports of anxiety about failure in East Asian groups. Exposure embarrassment, on the other hand, occurs when the individual is singled out by another for attention. Greater exposure embarrassment also was likely for Japanese children because their success leads them to stand out in the presence of an unfamiliar observer/evaluator. Thus, Japanese children are likely to show more embarrassment overall than the American groups.

The results are presented in Fig. 6. Shame was only observed during failure, and group differences were found. No Japanese children expressed shame, and there were no differences between White and African American children in the number of children showing shame. Thirty-five to 59% of all children showed evaluative embarrassment. There was some evidence of a group difference, with a greater percentage of Japanese children showing evaluative embarrassment than that of White American children, although the percentage of Japanese and African American children did not differ. The percentage of White and African American children also did not differ.

Sadness following failure occurred in about 45% of children in each of the two American groups; however, it was not observed in Japanese children. While there was no difference between White and African American children, both groups differed from Japanese children. The percentage of children expressing pride ranged from 33% to 76%. Fewer Japanese children expressed pride than either of the American groups, as well as there being no differences between White American and African American children.

The percentage of children showing exposure embarrassment varied from 11% to 64%. Comparison also revealed significantly more Japanese children showing exposure embarrassment than both White and African American children. The two American groups did not differ from one another. Enjoyment following success showed little variability. It occurred in approximately 80% of all children, and no group differences were observed.

Differences in Embarrassment Across Success and Failure. Figure 6 indicates that approximately 58% of Japanese children showed evaluative embarrassment and 64% showed exposure embarrassment. The difference between exposure embarrassment and evaluative embarrassment was not significant in Japanese children. Japanese children who showed exposure embarrassment were likely to show evaluative embarrassment; 48% showed both expressions. In contrast, both White and African American children showed differences between evaluative embarrassment and exposure embarrassment. White and African American children each were less likely to show exposure embarrassment than evaluative embarrassment. Compared to the Japanese children, fewer children in each group showed both expressions. Despite the limited window for differential socialization between age

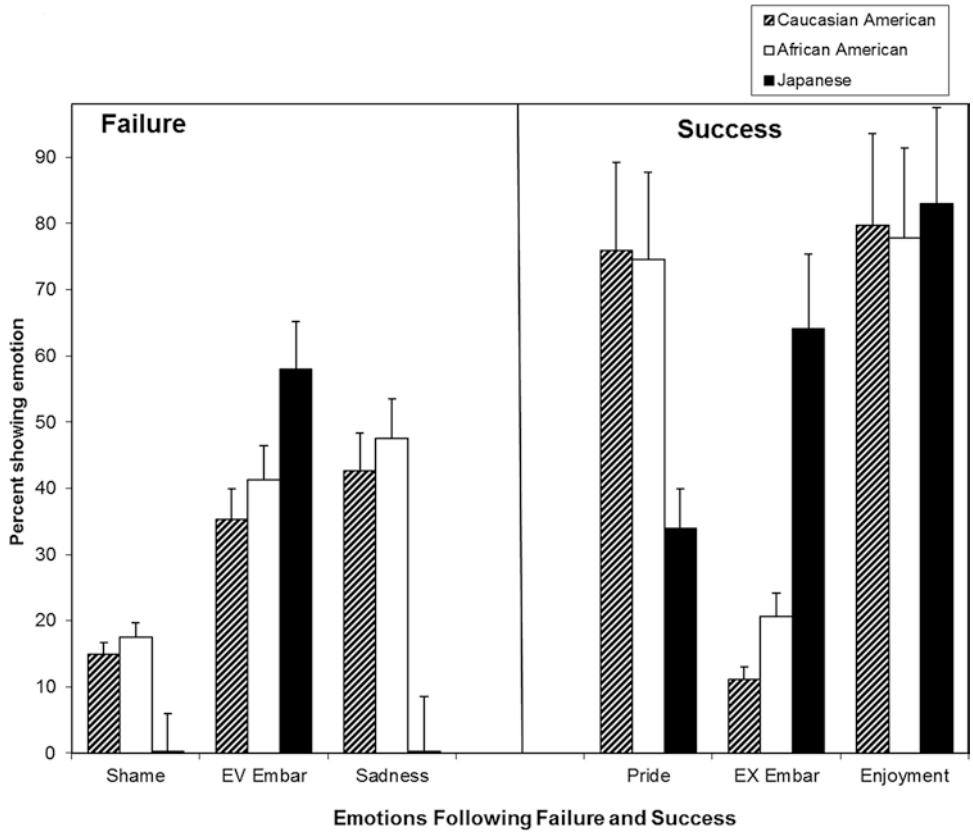

Fig. 6 Percent of children showing emotion by group

two and school age, the preschool children in the current study differed by culture. They differed in the emotions expressed in response to both failure and success, as well as in how many different expressions appeared in response to failure. This suggests that cultural differences emerge early, perhaps as soon as or shortly after expressions themselves. Culture clearly influenced the facial expressions of emotions in this study. Young Japanese children showed less sadness and shame in response to failure and were less likely than American children to show more than one type of expression in response to failure. In response to success, Japanese children were likely to express less pride and more evaluative embarrassment. Overall, the percentage of Japanese children who showed some versus no facial expression, as well as the mean number of expressions, did not differ from American children, suggesting that generalized suppression of emotional expressiveness did not occur in the Japanese children.

While there were differences between American and Japanese children, there were no differences between White American and African American children. There are few studies supporting emotional differences between African Americans and White Americans of European ancestry. Although there is some suggestion that African American children may be somewhat similar to Japanese children in terms of their reaction to failure (Lutwak, Razzino, & Ferrari, 1998), the present results provide no evidence that African American children behave differently from White American children in response to failure or success.

The significantly greater display of exposure embarrassment in Japanese children is most likely related to cultural differences in response to being the object of another's attention, since it does not vary with success and failure. Miyake and Yamazaki (1995) have argued that being the center of attention as opposed to being part of the

group is likely to be anxiety provoking and thus embarrassing for Japanese children. In contrast, being singled out for praise is far more common and actually socially desired in American culture. In light of these observations, the two forms of embarrassment, although mildly negative in tone, do not fit the temperament pattern of less negative expression reported in the literature for East Asian infants. Instead, the two embarrassment forms seem to be particularly sensitive to cultural differences in the meaning of the success or failure contexts to the children.

Shame and Psychopathology

Maltreatment and Shame

Our interest in shame as a mediating variable in children's psychopathology has been explored in a series of studies examining the effects of maltreatment on children's development. Examination of the conversion of shame to blame in juvenile offenders also sheds light on the effects of unfelt or converted shame on children's antisocial behavior. The particular model explored examined the moderating effects of shame on behavior problems. Figure 7 captures this paradigm.

Alessandri and Lewis (1996) first examined children's self-conscious emotions of shame and pride in 4- to 5-year-old maltreated children who were referred to us by the Department of Human Services and were matched with a control group from the same community. The task of easy versus difficult, and success and failure, used the paradigm reported above. While there were no differences between groups across task difficulty, there were significant sex differences as they interacted with maltreatment. Maltreated boys showed significantly less shame when they failed, or pride when they succeeded, than the nonmaltreated boys. For girls, maltreated girls showed significantly more shame when they failed and significantly less pride when they succeeded. Maternal behavior, as already reported, shows mothers exhibited more negative behavior toward their girl than boy children, and in the case of the maltreated girls, this negativity was associated with more shame when the girls failed. Such findings supported the model suggesting that maltreatment affects children's shame responses to failure for girls, while suppressing it for boys.

In another longitudinal study on the effects of shame on psychopathology, we examined the mediating effect of shame on children's depression (Bennett, Sullivan, & Lewis, 2010). Neglected children may be at increased risk for depressive symptoms (Egeland, Sroufe, & Erickson, 1983; Shields, Ryan, & Cicchetti, 2001). This study examined shame-proneness as an outcome of child neglect and as a potential explanatory variable in the relation between neglect and depressive symptoms. Participants were 111 children (52 with a Child Protective Services [CPS] allegation of neglect) seen at age seven. Using the research paradigm discussed earlier, there were two easy and two difficult tasks where the children succeeded in one of the two tasks and failed in one of the two tasks. Depression symptomatology was obtained from the children themselves using the CDI-S (Kovacs, 1992).

Neglected children reported more shame-proneness and more depressive symptoms than nonmaltreated children. Guilt-proneness, in contrast, was unrelated to neglect and depressive symptoms, indicating specificity for shame-proneness. Shame-proneness was related to increased depressive symptoms. Moreover, using a path analysis revealed

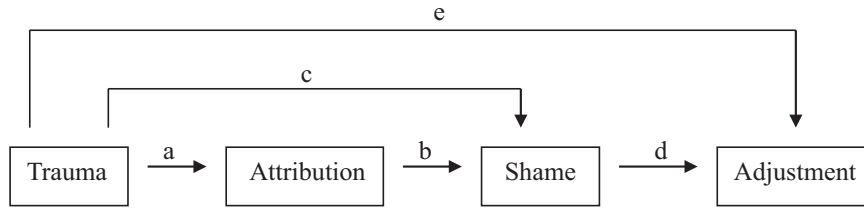

Fig. 7 A model of trauma and adjustment as they relate to shame

the indirect effect of maltreatment on depressive symptoms through shame-proneness, with 35% of the total effect of maltreatment on depressive symptoms accounted for by the indirect effect of shame.

In another study, we looked at maltreatment and shame as well as anger as they related to young children's adjustment (Bennett, Sullivan, & Lewis, 2005). In this study, we also examined the differences between physical punishment and neglect maltreatment. Figure 8 presents the proposed model. There is some evidence that physical abuse may be more related to anger than is neglect (Manly, Kim, Rogosch, & Cicchetti, 2001), while neglect may lead to internalizing problems.

A total of 177 children ages 3–7 were seen, 90 of whom had a history of maltreatment. Of this group, 44 had a history of neglect, 21 of abuse, and 25 had both abuse and neglect. Success and failure tasks were given to elicit shame and anger, which were coded from videotapes. The TRF (Achenbach, 1991) was completed by the children's teachers, and a total score, as well as internalizing and externalizing problems scores, obtained. Figure 8 shows the standard ß weights for physical abuse and for neglect maltreated children. Of particular interest was the finding that physical abuse more than neglect was associated with increases in shame; however, once shame occurred, both models indicated that shame's effect on anger and anger's effect on total behavior problems were equally related. That teachers' ratings were affected by the anger that children exhibited is interesting in light of teachers' ratings for externalizing being more related than total behavior scores.

The absence of a direct effect of shame and behavior problems is rather interesting. Shame's effect, especially for physically abused children, was its effect on anger, which in turn affected emotional problems. While the effect of shame directly affected depression in another sample

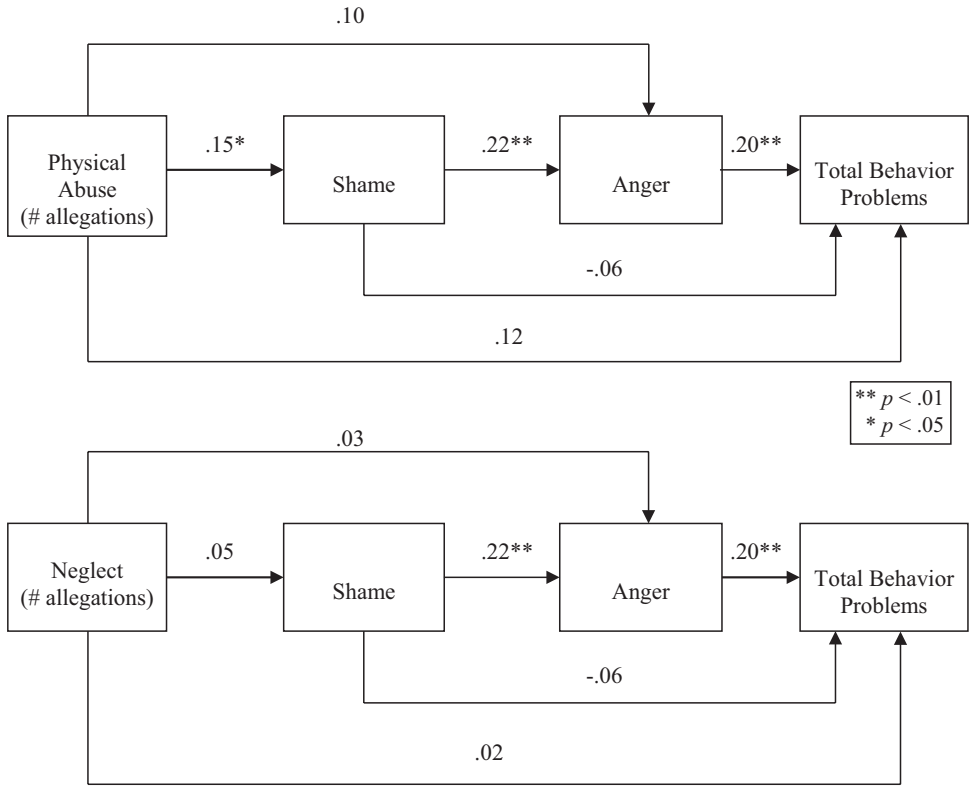

Fig. 8 Model predicting anger and total behavior problems as a function of physical abuse (panel **a**) and neglect (panel **b**) (standardized β weights are listed for each relation)

(Bennett et al., 2010), those children were neglected rather than physically abused, a potentially important difference since abuse and neglect may lead to different outcomes. It also raises the possibility that maltreatment leads some children to suppress their emotions, supporting a finding that boys more than girls suppress their feelings of shame and pride, which in turn may lead to differences in psychopathology.

Observations of these boys indicate higher amounts of such angry behaviors as throwing the test materials away, verbally aggressive statements, and (although not common) angry faces. Sullivan and Lewis (1999) measured these behaviors more carefully and found significant differences for maltreated and nonmaltreated boys' aggressive laboratory behavior. If these findings persist, the sex differences in response to traumas like maltreatment may explain why girls and women show high likelihood of depression, while boys and men show high likelihood of aggressive behavior, as a result of similar traumas. It is also interesting to note that children who are physically abused show more shame than those who are neglected (Lewis & Sullivan, 2005) since it suggested that suppressed or unfelt shame may lead to more aggression. We explored this possibility in another study.

Criminal Behavior and Shame

Physical abuse, especially in early childhood, may be likely to lead to serious forms of pathology through the mediation of suppressed shame and attributions which blame others. Gold, Sullivan, and I studied over 100 male adolescents who were incarcerated for antisocial behavior (2011). Examined was how parental punishment, particularly harsh punishment, affected these adolescents' delinquent behavior. The effect of harsh parental punishment was mediated by shame and attributions in regard to responsibility for their aggressive behavior, in particular blaming others. Using data on parental harsh punishment (beating and physical abuse), as well as data from the TOSCA-2 (Tangney et al., 1996), we were able to examine the adolescents' violent behavior. As seen in Fig. 9, harsh punishment was directly related to violent delinquent acts while non-harsh punishment was not. It was

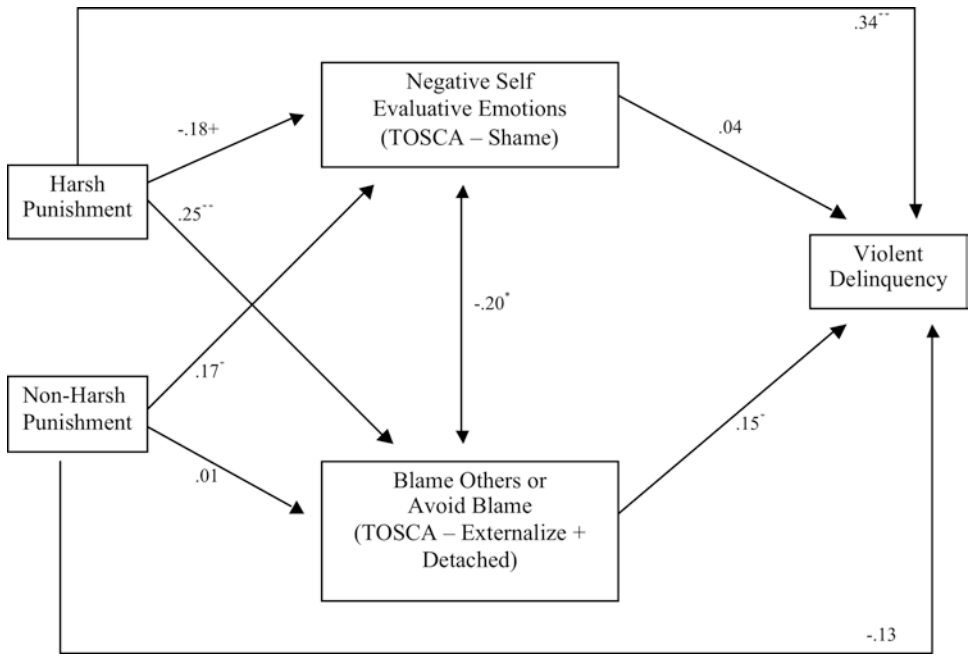

Fig. 9 Effects of harsh parenting on adolescents' emotions, attributions, and delinquent behavior: model of relations between maltreatment, emotions/attributions, and delinquency

also related to blaming others, which mediated the effects of punishment on violent delinquent behavior. Most importantly, the more they blamed others, the less responsibility they took, the less shame these adolescents reported. Given that these adolescents were all males, the finding that harsh punishment leads to suppression of shame in these male delinquents, which in turn may lead to more violent crime, can be seen by dividing these subjects into four groups based on their shame and blaming others as seen in their TOSCA data. The groups were (1) low expressed shame, low blame; (2) Converters, low shame, high blame; (3) high shame, low blame; and (4) high shame, high blame. Table 1 shows these data.

Observation of the level of abusive parenting using the Parent-Child Conflict Tactics Scale—Child Assessment (CTSPC-CA, Straus, Hamby, Finkelhor, Moore, & Runyan, 1998) showed that males with the two highest abusive parenting scores were in Group 2, the Converters, and Group 4 (the high expressions of shame and blame), who in turn had the two highest violent delinquency scores. In fact, it was the males who did not express shame but blamed others who had the highest violence scores.

These results indicate that abusive parenting impacts violent delinquency directly and indirectly through the effect of converting shame into blaming others. Subjects who converted shame into blaming others had significantly more exposure to abusive parenting and showed significantly more violent delinquent behavior than those who expressed shame. Although not significant, subjects who did express shame received more nonabusive parenting and showed less violent behavior than their peers who converted shame. Thus, the conversion of shame leads to more violent delinquency than those that expressed their shame.

The path to violent delinquency was not simply explained by abusive parenting, but that abuse exerts its influence on violent behavior through the conversion of shame. The link between shame and blaming others is a critical one. Previous conceptions such as unacknowledged or bypassed shame propose that when shame cannot be tolerated, it may be repressed and converted into other forms. Based on previous work (Bennett et al., 2005; Feiring, Taska, & Lewis, 1998) and the associations between blaming others and antisocial behavior (Cramer & Kelly, 2004), the data suggest that the conversion of shame to blaming others is a mechanism in the development and maintenance of violent delinquency.

By this view, violent delinquency can be considered a pathological response to trauma. Conversion of shame is a protective, seemingly functional response given an individual's consistent exposure to abusive parenting. Converting shame allows the shamed person to direct their focus—and behavior—away from the self, insulating them from their own intensely negative feelings. This process may help explain the low rates of expressed shame and high rates of recidivism associated with chronic, violent juvenile offenders (Coolbaugh & Hansel, 2000; Office of Juvenile Justice & Delinquency Prevention, 1998).

Table 1 Means and standard deviations for parenting and delinquency scores by shame/blame others groups

Shame/blame others groups	Abusive parenting	Nonabusive discipline	Violent delinquency
Group 1 (low shame, low blame others) n – 21	1.88 (1.33)[b]	2.37 (2.03)	2.65 (5.19)[b,c,d]
Group 2 – Converters (low shame, high blame others) n – 36	2.16 (1.13)[a,c,d]	2.99 (1.59)	6.19 (9.0)[a,c,d]
Group 3 – Expressers (high shame, low blame others) n – 36	1.40 (1.07)[b]	2.95 (1.16)	3.46 (9.43)[a,b,d]
Group 4 (high shame, high blame others) n – 19	1.85 (1.18)[b]	2.94 (1.84)	4.07 (6.55)[a,b,c]
ANOVA, $F(3, 108)$	2.58*	.80	–

*$p = 0.058$
[a]Different from group 1
[b]Different from group 2
[c]Different from group 3
[d]Different from group 4

Research on the therapeutic process identifies the acceptance of responsibility for one's own behavior is essential to the process of change (Prochaska & DiClemente, 1992; Prochaska, Velicer, Prochaska, Delucchi, & Hall, 2006). But, for individuals who avoid self-blame and see others as responsible for conflict, there is little motivation to alter their violent behavior, in part, because blaming others protects them against feeling their own shame. Consistent with descriptions of a "hostile attribution bias" (see review by Orobio de Castro, Veerman, Koops, Bosch, & Monshouwer, 2002), the conversion of shame into blaming others may be at the core of the reported difficulties in successfully altering the developmental trajectory of adolescents who engage in chronic and violent behavior.

How does the conversion of shame into blaming others come about? Our data suggest that converters (the low expressed shame, high blaming others group) received more abusive parenting than the expressers (the high shame, low blaming others group). This suggests that exposure to abusive parenting may be key to whether children express shame or convert shame into blaming of others. Abusive parenting not only is assaultive and serves as a model of violence toward others but also produces high levels of shame ("What's wrong with me that my parent beats me?") which may be intolerable. By modeling violence toward others, the abusive parent may also be reinforcing the conversion of shame into blaming of others.[1]

Sexual Abuse and Shame

Perhaps the clearest findings on the effect of shame and attributional style come from our work on adjustment following sexual abuse (Feiring et al., 1998; Feiring, Taska, & Lewis, 1996, 2002). This study examined the role of shame and self-blaming attributional style on the distress of child and adolescent victims of sexual abuse. A total of 142 participants, 82 children and 60 adolescents, were seen within 8 weeks of the discovery of the abuse, and then seen again 1 year later. Age and gender were not factors in our findings, so all subjects' data were combined.

The characteristics of the sexual abuse acts experienced were obtained and used as a measure of the severity of the abuse. Also obtained were the children's attributional style (CASQ, Kaslow & Nolen-Hoeksema, 1988) and a shame score. Depression symptoms (CDI, Kovacs, 1985) also were obtained, as was total PTSD. These measures were obtained at both the 8-week and 1-year post-discovery of the sexual abuse.

Figure 10 presents the data. At time one, soon after discovery of sexual abuse, abuse severity was associated with both shame and negative attribution, which in turn were both related to depression symptoms. At time two 1-year later, abuse severity was no longer associated with shame and negative attributions, although both still were related to depressive symptoms. These time two associations were stronger in their association with depression, while at the same time the severity of the sexual abuse became disassociated from shame and attribution style. In some sense then, over one year the shame and negative self-attributions became disassociated from the earlier sexual abuse and were themselves now the cause of the continued depressive symptoms.

This can be seen in Fig. 11, which shows how shame changes affected the depressive symptoms. Four groups of shame change were created, those subjects high on shame at T1 and T2, low on shame at T1 and T2, high at T1 but low at T2, and low at T1 but high at T2. Those children whose shame remained high over the year since the sexual abuse occurred remained high on both depressive symptoms and PTSD. Of particular importance was the group who were high in shame at T1 but low at T2. It was this group whose shame scores decreased the most and who also showed the most recovery in terms of low scores on depression and PTSD symptoms!

[1]We have reported that there are other events in childhood, such as parental verbal abuse—"You disgust me"—or ridicule, which can lead to higher levels of shame, which in turn lead to narcissism and to hubris. The conversion of shame into "it is not my fault" is a typical response of narcissistic personality (see Lewis, 2018).

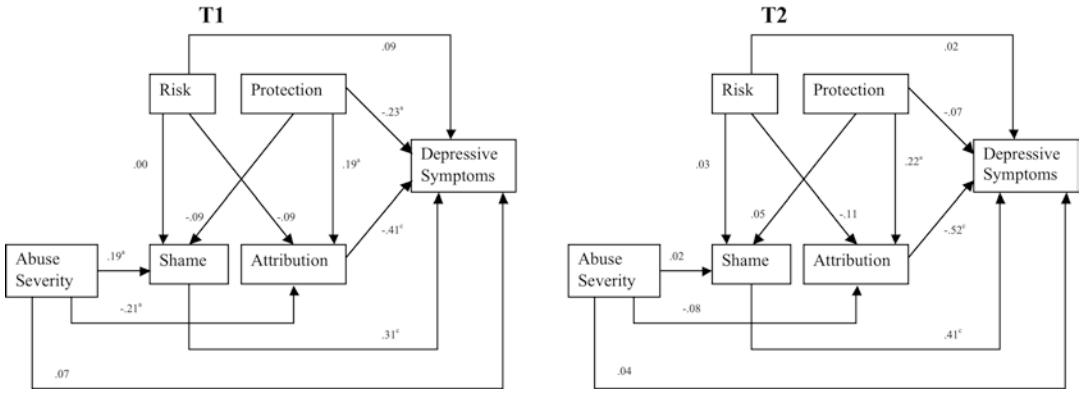

Fig. 10 Depression and shame in sexually abused children. [a]$p < 0.05$; [b]$p < 0.01$; [c]$p < 0.001$

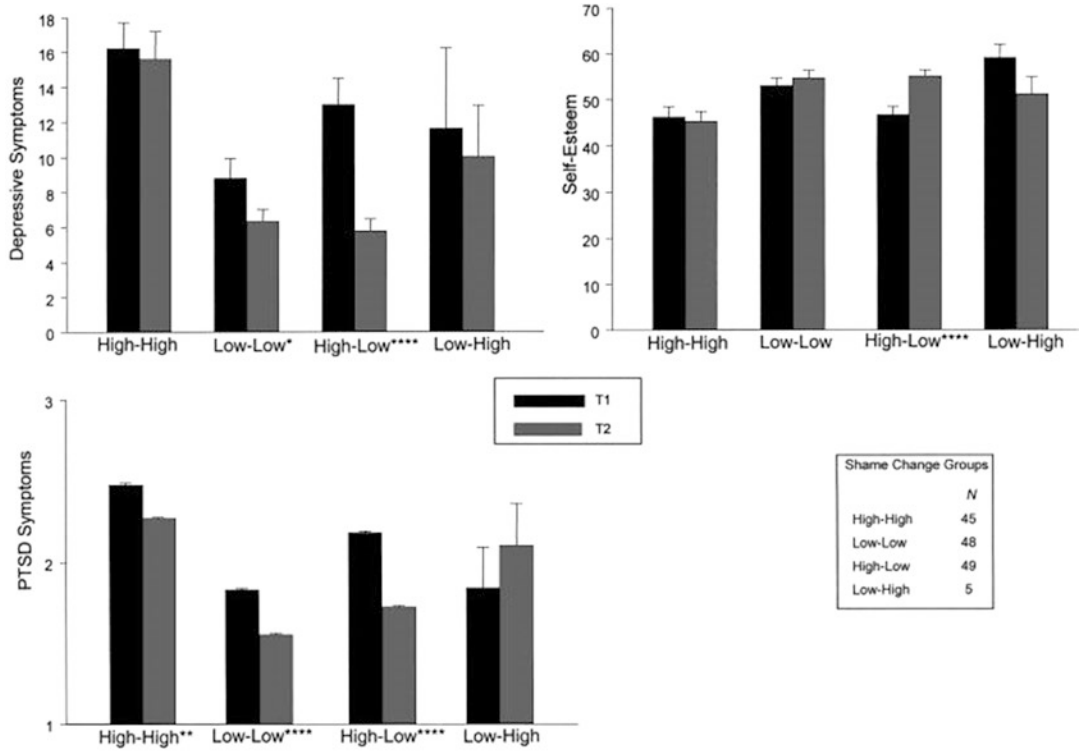

Fig. 11 Adjustment measures by shame change groups (standard errors are represented by vertical lines). High group membership was at or above the median of 3, and low group membership was below the median. PTSD post-traumatic stress disorder. Significant Time 1 (T1) to Time 2 (T2) differences: *$p < 0.05$; **$p < 0.01$; ****$p < 0.0001$

Summary

To summarize our empirical work on the story of shame leads to several important conclusions:

1. Shame, pride, and guilt, as well as embarrassment, can be measured directly in laboratory settings using behavioral measures as suggested above. This is especially important when studying young children, since TOSCA-2 cannot be used for young children.
2. Measurements of attributional styles using both our measures as well as those of Dweck and associates are available and are related as our theory of self-conscious emotional development suggests (Lewis, 1992a).
3. The relationship between these self-conscious emotions as measured is related to the development of psychopathology and may be useful as a guide for affecting clinical change in those children (and adults) with an overdeveloped sense of shame. As I suggested in *Shame, the Exposed Self, 2nd Edition* (Lewis, 1995b), many of the problems of poverty and delinquency, as well as gender differences in depression and aggression, can be linked to the issue of shame.

Darwin's theory of the self-conscious emotions (1872/1965) was an important beginning to our understanding of these emotions. My colleagues and I through research on self-reflection, attributions, and emotional expression have been able to expand on his theory (Lewis, 2010, 2014, 2015, 2016b; Lewis et al., 1989; Lewis & Brooks-Gunn, 1979; Lewis & Michalson, 1983). A theory of the development of the self-conscious emotions of embarrassment (two kinds), empathy, jealousy (envy), and shame, pride, guilt, and hubris has been presented. Two important developmental milestones have been suggested, the first being the movement from early action patterns to the emergence of the ability of self-referential behavior (the machinery of the self to the idea of me). The second is cognitive development, first, in internal standards, rules, and goals, and then evaluation of one's actions in regard to them. Together these developments of both internal ideas and cognitions created through the child's interaction with their social environment give rise to the rich network of specific self-conscious emotions. Individual differences in their development have been found useful in understanding many of the issues of developmental psychopathology, thus connecting the development of emotional life to issues of emotional and social adjustment.

References

Achenbach, T. M. (1991). *Manual for the teacher's report form and 1991 profile*. Burlington, NJ: University of Vermont Department of Psychiatry.

Ainsworth, M. D. S., & Bell, S. M. (1970). Attachment, exploration, and separation: Illustrated by the behavior of one-year-olds in a strange situation. *Child Development, 41*, 49–67.

Akiyama, M. (1992). Cross-linguistic contrasts of verification and answering among children. *Journal of Psycholinguistic Research, 21*, 67–85.

Alessandri, S. M., & Lewis, M. (1993). Parental evaluation and its relation to shame and pride in young children. *Sex Roles, 29*(5/6), 335–343.

Alessandri, S. M., & Lewis, M. (1996). Differences in pride and shame in maltreated and non-maltreated preschoolers. *Child Development, 67*, 1857–1869.

Alessandri, S. M., Sullivan, M. W., & Lewis, M. (1990). Violation of expectancy and frustration in early infancy. *Developmental Psychology, 26*(5), 738–744.

Baillargeon, R., Li, J., Gertner, Y., & Wu, D. (2011). How do infants reason about physical events? In U. Goswami (Ed.), *The Wiley-Blackwell handbook of childhood cognitive development* (2nd ed., pp. 11–48). Malden, MA: Wiley-Blackwell.

Barrett, K. C., & Zahn-Waxler, C. (1987, April). *Do toddlers express guilt?* Poster presented at the meeting of the Society for Research in Child Development, Toronto.

Baumeister, R. F., Campbell, J., Kreuger, J., & Vohs, K. D. (2003). Does high self-esteem cause better performance, interpersonal success, happiness, or healthier lifestyles? *Psychological Science in the Public Interest, 4*(1), 1–44.

Beck, A. T. (1979). *Cognitive therapy and emotional disorders*. New York: Times Mirror.

Belck, J. (2017, November). The rights of plants. *The MOON Magazine*, Retrieved from http://moonmagazine.org/jack-belck-rights-plants-2017-11-05/

Benedict, R. (1946). *The chrysanthemum and the sword*. Boston: Houghton-Mifflin.

Bennett, D. S., Sullivan, M. W., & Lewis, M. (2005). Young children's adjustment as a function of maltreatment, shame, and anger. *Child Maltreatment, 10*(4), 311–323.

Bennett, D. S., Sullivan, M. W., & Lewis, M. (2010). Neglected children, shame-proneness and depressive symptoms. *Child Maltreatment, 15*(4), 305–314. https://doi.org/10.1177/1077559510379634

Bischof-Kohler, A. (1991). The development of empathy in infants. In M. E. Lamb & H. Keller (Eds.), *Development: Perspectives from German-speaking countries* (pp. 245–273). Hillsdale, NJ: Lawrence Erlbaum.

Bradley, B. S. (2010). Jealousy in infant-peer trios: From narcissism to culture. In S. L. Hart & M. Legerstee (Eds.), *Handbook of jealousy: Theory, research, and multi- disciplinary approaches* (pp. 192–234). Malden, MA: Blackwell Publishing Ltd./Wiley.

Buss, A. H. (1980). *Self-consciousness and social anxiety*. San Francisco: W.H. Freeman.

Butterworth, G. (1992). Origins of self-perception in infancy. *Psychological Inquiry, 3*, 103–111.

Carey, W. B., & McDevitt, S. C. (1978). Revision of the infant temperament questionnaire. *Pediatrics, 61*, 735–739.

Cole, P. M., Barrett, K. C., & Zahn-Waxler, C. (1992). Emotion displays in two-year-olds. *Child Development, 63*, 314–324.

Coolbaugh, K., & Hansel, C. J. (2000). *The comprehensive strategy: Lessons learned from the pilot sites*. Washington, D.C.: US Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention.

Cramer, P., & Kelly, F. D. (2004). Defense mechanisms in adolescent conduct disorder and adjustment reaction. *Journal of Nervous and Mental Disorders, 192*(2), 139–145.

Darwin, C. (1887). *The autobiography of Charles Darwin: 1809–1882*, ed. by Nora Barlow (1959; New York: W.W. Norton & Co., 1993), pp 131–132.

Darwin, C. R. (1965). *The expression of the emotions in man and animals*. Chicago, IL: University of Illinois Press. (Original work published in 1872).

Dennett, D. C. (2009). *Darwin and the evolution of 'why'? (Abstract)*. Cambridge: Darwin Festival.

DiBiase, R., & Lewis, M. (1997). The relation between temperament and embarrassment. *Cognition and Emotion, 11*, 259–271.

Dweck, C. S. (1996). Social motivation: Goals and social-cognitive processes. In J. Juvonen & K. R. Wentzel (Eds.), *Social motivation: Understanding children's school adjustment* (pp. 181–195). New York: Cambridge University Press.

Dweck, C. S. (2006). *Mindset: The new psychology of success*. New York: Random House.

Dweck, C. S., Chiu, C., & Hong, Y. (1995). Implicit theories and their role in judgments and reactions: A world from two perspectives. *Psychological Inquiry, 6*, 267–285.

Dweck, C. S., Davidson, W., Nelson, S., & Enna, B. (1978). The differences in learned helplessness: II. The contingencies of evaluative feedback in the classroom, and III. An experimental analysis. *Developmental Psychology, 14*, 268–276.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review, 95*, 256–273.

Eccles, J. S., & Blumefeld, P. (1985). Classroom experiences and student gender: Are there differences and do they matter? In L. G. Wilkinson & G. B. Marrett (Eds.), *Gender influences in the classroom* (pp. 79–113). New York: Academic Press.

Edelman, R. J., & Hampson, S. E. (1979). Changes in non-verbal behavior during embarrassment. *The British Journal of Social and Clinical Psychology, 18*, 385–390.

Edelmann, R. J., & Iwawaki, S. (1987). Self-reported expression and consequences of embarrassment in the United Kingdom and Japan. *Psychologia: An International Journal of Psychology in the Orient, 30*, 205–216.

Egeland, B., Sroufe, L., & Erickson, M. (1983). The developmental consequences of different patterns of maltreatment. *Child Abuse & Neglect, 7*, 459–469.

Ekman, P., & Friesen, W. V. (1975). *Unmasking the face: A guide to recognizing emotions from facial clues*. Englewood Cliffs, NJ: Prentice-Hall.

Ekman, P., & Friesen, W. V. (1978). *Facial action coding system: A technique for the measurement of facial movement*. Palo Alto, CA: Consulting Psychologists Press.

Erikson, E. (1950). *Childhood and society*. New York: Norton.

Eysenck, H. J. (1954). *The psychology of politics*. London: Routledge & Kegan Paul.

Feiring, C., & Lewis, M. (1979). Sex and age differences in young children's reactions to frustration: A further look at the Goldberg and Lewis (1969) subjects. *Child Development, 50*, 848–853.

Feiring, C., Taska, L., & Lewis, M. (1996). A process model for understanding adaptation to sexual abuse: The role of shame in defining stigmatization. *Child Abuse & Neglect, 20*(8), 767–782.

Feiring, C., Taska, L., & Lewis, M. (1998). The role of shame and attributional style in children's and adolescents' adaptation to sexual abuse. *Child Maltreatment, 3*(2), 129–142.

Feiring, C., Taska, L., & Lewis, M. (2002). Adjustment following sexual abuse discovery: The role of shame and attributional style. *Developmental Psychology, 38*(1), 79–92.

Freud, S. (1953). Three essays on the theory of sexuality. In J. Strachey (Ed. & Trans.) in collaboration with A. Freud, *The standard edition of the complete psychological works of Sigmund Freud* (Vol. 7). London: The Hogarth Press and the Institute of Psychoanalysis. (Originally published 1905).

Freud, S. (1963). *The problem of anxiety* (H.A. Bunker, Trans.) New York: Norton. (Original work published in 1936).

Geppert, U. (1986). *A coding system for analyzing behavioral expressions of self-evaluative emotions*. Munich, Germany: Max Planck Institute for Psychological Research.

Gold, J., Sullivan, M. W., & Lewis, M. (2011). The relation between abuse and violent delinquency: The conversion of shame to blame in juvenile offenders. *Child Abuse & Neglect, 35*(7), 459–467.

Goldberg, S., & Lewis, M. (1969). Play behavior in the year-old infant: Early sex differences. *Child Development, 40*, 21–31.

Gruenewald, T. L., Kemeny, M. E., Aziz, N., & Fahey, J. L. (2004). Acute threat to the social self: Shame, social self-esteem, and cortisol activity. *Psychosomatic Medicine, 66*, 915–924.

Gunderson, E. A., Gripshover, S. J., Romero, C., & Dweck, C. S. (2013). Parent praise to 1- to 3-year-olds predicts children's motivational frameworks 5 years later. *Child Development, 84*, 1526–1541.

Haimovitz, K., & Corpus, J. H. (2011). Effects of person versus process praise on student motivation: Stability and change in emerging adulthood. *Educational Psychology, 31*, 595–609.

Hamlin, J. K. (2013). Moral judgment and action in preverbal infants and toddlers: Evidence for an innate moral core. *Current Directions in Psychological Science, 22*, 186–193.

Hamlin, J. K., & Wynn, K. (2011). Young infants prefer prosocial to antisocial others. *Cognitive Development, 26*, 30–39.

Harding, V., Gray, J. E., McClure, B. A., Anderson, M. A., & Clarke, A. E. (1990). Self-incompatibility: A self recognition system in plants. *Science, 250*, 937–941.

Harrington, D. M., Block, J. H., & Block, J. (1975). *Behavioral manifestations and parental correlates of intolerance of ambiguity in young children.* Paper presented at the meetings of the Society for Research in Child Development, Denver.

Harris, P. L., & Gross, D. (1988). Children's understanding of real and apparent emotion. In J. W. Astington, P. L. Harris, & D. R. Olson (Eds.), *Developing theories of mind* (pp. 295–314). Cambridge: Cambridge University Press.

Hart, S. L. (2010). The ontogenesis of jealousy in the first year of life: A theory of jealousy as a biologically-based dimension of temperament. In S. Hart & M. Legerstee (Eds.), *Handbook of jealousy: Theory, research, and multidisciplinary approaches* (pp. 57–82). Malden, MA/Oxford: Blackwell Publishing, Ltd/Wiley.

Hart, S. L., & Legerstee, M. (Eds.). (2010). *Handbook of jealousy: Theory, research, and multidisciplinary approaches*. Malden, MA: Blackwell Publishing Ltd./Wiley.

Heckhausen, H. (1984). Emergent achievement behavior: Some early developments. In J. Nicholls (Ed.), *The development of achievement motivation* (pp. 1–32). Greenwich: CT JAI Press.

Hilgard, E. R. (1977). *Divided consciousness: Multiple controls in human thought and action*. New York: Wiley.

Hobson, R. P. (2010). Is jealousy a complex emotion? In S. L. Hart & M. Legerstee (Eds.), *Handbook of jealousy: Theory, research, and multidisciplinary approaches* (pp. 293–311). Malden, MA: Blackwell Publishing Ltd./Wiley.

Izard, C. E. (1971). *The face of emotion*. New York: Appleton-Century-Crofts.

Izard, C. E. (1977). *Human emotions*. New York: Plenum Press.

Izard, C. E. (1979). *The maximally discriminative facial movement coding system (MAX)*. Newark, DE: Instructional resources Center, University of Delaware.

James, W. (1890). *The principles of psychology*. New York: Holt.

Janoff-Bulman, R. (1979). Characterological versus behavioral self-blame: Inquiries into depression and rape. *Journal of Personality and Social Psychology, 37*, 1798–1809.

Kagan, J. (1981). *The second year: The emergence of self-awareness*. Cambridge, MA: Harvard University Press.

Kagan, J., Reznick, J. S., & Snidman, N. (1988). Biological bases of childhood shyness. *Science, 240*, 167–171.

Kamins, M. L., & Dweck, C. S. (1999). Person versus process praise and criticism: Implications for contingent self-worth and coping. *Developmental Psychology, 35*, 835–847.

Kaslow, N. J., & Nolen-Hoeksema, S. K. (1988). *Children's attributional style questionnaire—Short form*. Unpublished manuscript, Yale University, School of Medicine, New Haven, CT.

Keller, H., & Lamm, B. (2010). Culture, parenting, and the development of jealousy. In S. L. Hart & M. Legerstee (Eds.), *Handbook of jealousy: Theory, research, and multidisciplinary approaches* (pp. 477–497). Malden, MA: Blackwell Publishing Ltd./Wiley.

Kitayama, S., & Markus, H. R. (1999). Yin and Yang of the Japanese self: The cultural psychology of personality coherence. In D. Cervone & Y. Shoda (Eds.), *The coherence of personality: Social-cognitive bases of consistency, variability, and organization* (pp. 242–302). New York, NY: Guilford Press.

Kitayama, S., Markus, H. R., Matsumoto, H., & Norasakkunkit, V. (1997). Individual and collective processes in the construction of the self: Self-enhancement in the United States and self-criticism in Japan. *Journal of Personality and Social Psychology, 72*, 1245–1267.

Kitayama, S., Snibbe, A. C., Markus, H. R., & Suzuki, T. (2004). Is there any "free" choice? Self and dissonance in two cultures. *Psychological Science, 15*, 527–533.

Kovacs, M. (1985). The Children's Depression Inventory (CDI). *Psychopharmacology Bulletin, 21*, 995–998.

Kovacs, M. (1992). *Children's depression inventory manual*. North Tonawanda, NY: Multi-Health Systems.

Leslie, A. M. (1987). Pretense and representation: The origin of "theory of mind". *Psychological Review, 94*, 412–426.

Lewis, H. B. (1971). *Shame and guilt in neurosis*. New York: International Universities Press.

Lewis, H. B. (1987). Shame: The 'sleeper' in psychopathology. In H. B. Lewis (Ed.), *The role of shame in symptom formation* (pp. 1–28). Hillsdale, NJ: Erlbaum.

Lewis, M. (1989). Culture and biology: The role of temperament. In P. Zelazo & R. Barr (Eds.), *Challenges to developmental paradigms* (pp. 203–223). Hillsdale, NJ: Erlbaum.

Lewis, M. (1992a). *Shame, the exposed self*. New York: The Free Press.

Lewis, M. (1992b). The self in self-conscious emotions. A commentary in Stipek, D., Recchia, S., & McClintic, S. *Self-evaluation in young children. Monographs of the Society for Research in Child Development, 57*, (1, Serial No. 226).

Lewis, M. (1993). The development of deception. In M. Lewis & C. Saarni (Eds.), *Lying and deception in everyday life* (pp. 90–105). New York: Guilford Press.

Lewis, M. (1995a). Embarrassment: The emotion of self exposure and evaluation. In J. P. Tangney & K. W. Fischer (Eds.), *Self-conscious emotions: The psychology of shame, guilt, embarrassment, and pride* (pp. 198–218). New York: Guilford Press.

Lewis, M. (1995b). *Shame, the exposed self* (Paperback edition). New York: The Free Press.

Lewis, M. (1997). *Altering fate: Why the past does not predict the future*. New York: Guilford Press.

Lewis, M. (2003). The emergence of consciousness and its role in human development. In J. LeDoux, J. Debiec, & H. Moss (Eds.), *The self: From soul to brain* (Vol. 1001, pp. 1–29). New York: Annals of the New York Academy of Sciences. Also appearing on the ANNALS ONLINE. (www.annalsnyas.org)

Lewis, M. (2010). The emergence of consciousness and its role in human development. In R. Lerner & W. Overton (Eds.), *The handbook of lifespan Development* (Cognition, biology, and methods) (Vol. 1, pp. 628–670). Malden, MA: Wiley.

Lewis, M. (2014). *The rise of consciousness and the development of emotional life*. New York: Guilford Press.

Lewis, M. (2015). Emotional development and consciousness. In W. F. Overton & P. C. M. Molenaar (Eds.), *Handbook of child psychology and developmental science* (Theory & method) (Vol. 1, 7th ed., pp. 407–451). Hoboken, NJ: Wiley.

Lewis, M. (2016a). Self-conscious emotions: Embarrassment, pride, shame, and guilt. In L. Feldman Barrett, M. Lewis, & J. M. Haviland-Jones (Eds.), *Handbook of emotions* (4th ed., pp. 792–814). New York: Guilford Press.

Lewis, M. (2016b). The emergence of human emotions. In L. Feldman Barrett, M. Lewis, & J. M. Haviland-Jones (Eds.), *Handbook of emotions* (4th ed., pp. 272–292). New York: Guilford Press.

Lewis, M. (2018). From deception to authenticity: The rise of narcissism and the death of etiquette. *Research in Human Development, 15*, 211–223. Published online September 14, https://doi.org/10.1080/15427609.2018.1502546

Lewis, M., Alesandri, S., & Sullivan, M. W. (1990). Violation of expectancy, loss of control, and anger in young infants. *Developmental Psychology, 26*(5), 745–751.

Lewis, M., Alessandri, S., & Sullivan, M. W. (1992). Differences in shame and pride as a function of children's gender and task difficulty. *Child Development, 63*, 630–638.

Lewis, M., & Brooks-Gunn, J. (1979). *Social cognition and the acquisition of self*. New York: Plenum.

Lewis, M., & Michalson, L. (1983). *Children's emotions and moods: Developmental theory and measurement*. New York: Plenum.

Lewis, M., & Ramsay, D. (2002). Cortisol response to embarrassment and shame. *Child Development, 73*(4), 1034–1045.

Lewis, M., & Ramsay, D. (2004a). Development of self-recognition, personal pronoun use, and pretend play during the 2nd year. *Child Development, 75*(6), 1821–1831.

Lewis, M., & Ramsay, D. (2004b). Infant emotional response to goal blockage, control, and cortisol response. *Emotion Researcher, 19*(2), 8–9.

Lewis, M., & Ramsay, D. (2005). Infant emotional and cortisol responses to goal blockage. *Child Development, 76*(2), 518–530.

Lewis, M., & Ramsay, D. S. (1997). Stress reactivity and self-recognition. *Child Development, 68*, 621–629.

Lewis, M., Stanger, C., Sullivan, M. W., & Barone, P. (1991). Changes in embarrassment as a function of age, sex and situation. *British Journal of Developmental Psychology, 9*, 485–492.

Lewis, M., & Sullivan, M. (2005). The development of self-conscious emotions. In A. Elliott & C. Dweck (Eds.), *Handbook of competence and motivation* (pp. 185–201). New York: Guilford.

Lewis, M., Sullivan, M. W., & Kim, M. S. (2015). Infant approach and withdrawal in response to a goal blockage; its antecedent causes and its effect on toddler persistence. *Developmental Psychology, 51*(11), 1553–1563.

Lewis, M., Sullivan, M. W., & Michalson, L. (1984). The cognitive-emotional fugue. In C. E. Izard, J. Kagan, & R. Zajonc (Eds.), *Emotions, cognition, and behavior* (pp. 264–288). New York: Cambridge University Press.

Lewis, M., Sullivan, M. W., Ramsay, D. S., & Alessandri, S. M. (1992). Individual differences in anger and sad expressions during extinction: Antecedents and consequences. *Infant Behavior and Development, 15*, 443–452.

Lewis, M., Sullivan, M. W., Stanger, C., & Weiss, M. (1989). Self-development and self-conscious emotions. *Child Development, 60*, 146–156.

Lewis, M., Takai-Kawakami, K., Kawakami, K., & Sullivan, M. (2010). Cultural differences in emotional responses to success and failure. *International Journal of Behavioral Development, 34*(1), 53–61.

Lutwak, N., Razzino, B. E., & Ferrari, J. R. (1998). Self-perception and moral affect: An exploratory analysis of subcultural diversity in guilt and shame emotions. *Journal of Social Behavior and Personality, 13*, 333–348.

Mandler, G. (1975). *Mind and emotion*. New York: Wiley.
Manly, J. T., Kim, J. E., Rogosch, F. A., & Cicchetti, D. (2001). Dimensions of child maltreatment and children's adjustment: Contributions of developmental timing and subtype. *Development and Psychopathology, 13*, 759–782.
Margolin, G., & Patterson, G. R. (1975). Differential consequences provided by mothers and fathers for their sons and daughters. *Developmental Psychology, 11*, 537–538.
Markus, H. R., & Kitayama, S. (1994). The cultural construction of self and emotion: Implications for social behavior. In S. Kitayama & H. R. Markus (Eds.), *Emotion and culture: Empirical studies of mutual influence* (pp. 89–130). Washington, D.C.: American Psychological Association.
Mascolo, M. P., & Fischer, K. W. (2010). The dynamic development of thinking, feeling, and acting over the life span. In W. F. Overton & R. M. Lerner (Eds.), *The handbook of life-span development* (*Cognition, biology and methods*) (Vol. 1, pp. 149–194). Hoboken, NJ: Wiley.
Miyake, K., & Yamazaki, K. (1995). Self-conscious emotions, child rearing, and child psychopathology in Japanese culture. In J. P. Tangney & K. W. Fischer (Eds.), *Self-conscious emotions: The psychology of shame, guilt, embarrassment, and pride* (pp. 488–504). New York, NY: Guilford Press.
Modigliani, A. (1971). Embarrassment, facework, and eye contact: Testing a theory of embarrassment. *Journal of Personality and Social Psychology, 17*, 15–24.
Morrison, A. P. (1989). *Shame: The underside of narcissism*. Hillsdale, NJ: Analytic Press.
Mueller, C. M., & Dweck, C. S. (1998). Praise for intelligence can undermine children's motivation and performance. *Journal of Personality and Social Psychology, 75*, 33–52.
Ng, F. F., Pomerantz, E. M., & Lam, S. (2007). European American and Chinese parents' responses to children's success and failure: Implications for children's responses. *Developmental Psychology, 43*, 1239–1235.
Office of Juvenile Justice and Delinquency Prevention. (1998). *Serious and violent juvenile offenders*. Washington D.C.: Department of Justice, Office of Justice Programs (May).
Orobio de Castro, B., Veerman, J. W., Koops, W., Bosch, J. D., & Monshouwer, H. J. (2002). Hostile attribution of intent and aggressive behavior: A meta-analysis. *Child Development, 73*(3), 916–934.
Osofsky, J. D., & O'Connell, E. J. (1972). Parent-child interaction: Daughters' effects upon mothers' and fathers' behaviors. *Developmental Psychology, 7*, 157–168.
Parsons, J. E., Ruhle, D. N., Hodges, K. L., & Small, A. W. (1976). Cognitive-developmental factors in emerging sex differences in achievement-related expectancies. *Journal of Social Issues, 32*, 47–61.
Piaget, J. (1952). *The origins of intelligence in children* (M. Cook, Trans.) New York: International Universities Press. (Original work published in 1936).
Piaget, J., & Inhelder, B. (1969). *The psychology of the child*. New York: Basic.
Plutchik, R. (1980). A general psychoevolutionary theory of emotion. In R. Plutchik & H. Kellerman (Eds.), *Emotion: Theory, research, and experience* (Vol. I, pp. 3–33). New York: Academic.
Preston, S. D., & de Waal, F. B. M. (2002). Empathy: Its ultimate and proximate bases. *Behavioral and Brain Sciences, 25*, 1–71.
Prochaska, J. J., Velicer, W. F., Prochaska, J. O., Delucchi, K., & Hall, S. M. (2006). Comparing intervention outcomes in smokers treated for single versus multiple behavioral risks. *Health Psychology, 25*, 380–388.
Prochaska, J. O., & DiClemente, C. C. (1992). *Stages of change in the modification of problem behaviors*. Newbury Park, CA: Sage.
Putnam, H. (1963). Brains and behavior. In R. J. Butler (Ed.), *Analytical philosophy, second series* (pp. 211–235). Oxford: Basis Blackwell.
Rothbart, M. K., Ahadi, S. A., & Hershey, K. L. (1994). Temperament and social behavior in childhood. *Merrill-Palmer Quarterly, 40*, 21–39.
Roth-Hanania, R., Davidov, M., & Zahn-Waxler, C. (2011). Empathy development from 8 to 16 months: Early signs of concern for others. *Infant Behavior and Development, 34*, 447–458.
Ruffman, T., Lorimer, B., & Scarf, D. (2017). Do infants really experience emotional contagion? *Child Development Perspectives, 11*, 270–274.
Sagi, A., & Hoffman, M. L. (1976). Empathic distress in the newborn. *Developmental Psychology, 12*(2), 175–176.
Salvadori, E., Blazsekova, T., Volein, A., Karap, Z., Tatone, D., Mascaro, O., & Csibra, G. (2015). Probing the strength of infants' preference for helpers over hinderers: Two replication attempts of Hamlin and Wynn (2011). *PLoS One, 10*(11), e0140570.
Scherer, K. R., Matsumoto, D., Wallbott, D., & Kudoh, T. (1988). Emotional experience in a cultural context: A comparison between Europe, Japan, and the United States. In K. Scherer (Ed.), *Facets of emotion: Recent research* (pp. 5–30). Hillsdale, NJ: Erlbaum.
Seligman, M. E. P., Peterson, C., Kaslow, N., Tanenbaum, R., Alloy, L., & Abramson, L. (1984). Attributional style and depressive symptoms among children. *Journal of Abnormal Psychology, 39*, 235–238.
Shields, A., Ryan, R. M., & Cicchetti, D. (2001). Narrative representations of caregivers and emotion dysregulation as predictors of maltreated children's rejection by peers. *Developmental Psychology, 37*, 321–337.
Stein, A. H., & Bailey, M. M. (1973). The socialization of achievement orientation in females. *Psychological Bulletin, 80*, 345–366.
Stern, D. (1984). *The interpersonal world of the child*. New York: Basic Books.

Stigler, J. W., Smith, S., & Mao, L. (1985). The self-perception of competence by Chinese children. *Child Development, 56*, 1259–1270.

Stipek, D., Recchia, S., & McClintic, S. (1992). Self evaluation in young children. *Monographs of the Society for Research in Child Development, 57*, 1–95.

Straus, M. A., Hamby, S. L., Finkelhor, D., Moore, D., & Runyan, D. (1998). *Parent-child conflict tactics scale, revised*. Durham, NH: Family Research Laboratory, University of New Hampshire.

Sullivan, M. W., & Lewis, M. (1999, April). *The emotions of maltreated children in response to success and failure.* Presented at the biennial meeting of the Society for Research in Child Development, Albuquerque, NM.

Talwar, V., & Lee, K. (2008). Social and cognitive correlates of children's lying behavior. *Child Development, 79*(4), 866–881.

Tangney, J. P. (1990). Assessing individual differences in proneness to shame and guilt: Development of the self-conscious affect and attribution inventory. *Journal of Personality and Social Psychology, 59*, 102–111.

Tangney, J. P., & Dearing, R. L. (2002). *Shame and guilt*. New York, NY: Guilford Press.

Tangney, J. P., Ferguson, T. J., Wagner, P. E., Crowley, S. L., & Gramzow, R. (1996). *The test of self-conscious Affect-2 (TOSCA-2)*. Fairfax, VA: George Mason University.

Tangney, J. P., Wagner, P. E., Burggraf, S. A., Gramzow, R., & Fletcher, C. (1990). *The test of self-conscious affect for children (TOSCA-C)*. Farifax, VA: George Mason University.

Thomas, A., Chess, S., Birch, H., Hertzig, M. E., & Korn, S. (1963). *Behavioral individuality in early childhood*. New York: New York University Press.

Tomkins, S. S. (1963). *Affect, imagery, consciousness: Vol. 2. The negative affects*. New York: Springer.

Tracy, J. L., & Robins, R. W. (2004). Show your pride: Evidence for a discrete emotion expression. *Psychological Science, 15*, 194–197.

Tracy, J. L., & Robins, R. W. (2007). The psychological structure of pride: A tale of two facets. *Journal of Personality and Social Psychology, 92*(3), 506–525.

Tracy, J. L., Robins, R. W., & Lagattuta, K. H. (2005). Can children recognize pride? *Emotion, 5*, 251–257.

Trevarthen, C. B., & Aitken, K. J. (2001). Infant intersubjectivity: Research, theory and clinical applications. *Journal of Child Psychology and Psychiatry, 42*, 3–48.

Tronick, E. Z., Als, H., Adamson, L., Wise, S., & Brazelton, T. B. (1978). The infant's response to entrapment between contradictory messages in face-to-face interaction. *Journal of the American Academy of Child Psychiatry, 17*, 1–13.

Von Bertalanffy, L. (1967). *Robots, men, and minds*. New York: Brazilles.

Von Boehmer, H., & Kisielow, P. (1990). Self-nonself discrimination by T. cells. *Science, 248*, 1369–1372.

Wasserman, G. A., & Lewis, M. (1985). Infant sex differences: Ecological effects. *Sex Roles: A Journal of Research, 12*, 665–675.

Weinberg, K. M., & Tronick, E. Z. (1996). Infant affective reactions to the resumption of maternal interaction after the still-face. *Child Development, 67*, 905–914.

Weiner, B. (1986). *An attributional theory of motivation and emotion*. New York: Springer-Verlag.

Weinraub, M., & Lewis, M. (1977). The determinants of children's responses to separation. *Monographs of the Society for Research in Child Development, 42* (4, Serial No. 172), 1–78.

Werner, H. (1961). *Comparative psychology of mental development*. New York: Science Editions.

Whiting, R. (1990). *You gotta have wa*. New York: Vintage.

Prosocial Emotions

Tracy L. Spinrad and Nancy Eisenberg

Abstract

Prosocial emotions are thought to contribute to prosocial behaviors (behaviors intended to benefit another, such as helping, sharing, and comforting). The purpose of this chapter is to discuss children's prosocial emotions and to review literature relevant to their development and origins. First, we review basic definitional and conceptual issues. We specifically focus on the prosocial emotions of empathy-related responding (i.e., empathy, sympathy, personal distress) and guilt (which can evoke sympathy). Then, we review literature on the emergence of prosocial emotions in childhood. Next, we consider the origins of individual differences in prosocial emotions, focusing on selected individual characteristics (e.g., genetics, sociocognitive abilities), as well as the socialization of empathy-related responding and guilt in the family. The relations of temperamental characteristics (i.e., emotionality, regulatory skills, shyness/inhibition) to prosocial emotions are also discussed. We argue that more research studying meditational processes and moderation is needed. Finally, we provide areas for future directions in research.

Prosocial emotions have been considered important aspects of children's development because they are thought to contribute to moral values and moral behavior (Batson, 1991; Eisenberg, Spinrad, & Knafo-Noam, 2015; Hoffman, 2000). In this chapter, we focus on empathy-related emotions (i.e., empathy, sympathy, personal distress) and the sometimes related (Hoffman, 2000) moral emotion of guilt. To begin, we discuss important definitional and theoretical issues when conceptualizing prosocial emotions and provide a review of the normative development of empathy-related responding and guilt. Next, we consider the origins of prosocial emotions, with an emphasis on individual characteristics (i.e., genetic, sociocognitive), parental socialization, and temperamental characteristics. Finally, we briefly highlight some areas for future research.

Definitional Issues

In understanding prosocial emotions, Eisenberg and colleagues (Eisenberg, 1986; see Eisenberg, Spinrad, & Knafo-Noam, 2015) and others (Batson, 1991) have argued that it is important to

T. L. Spinrad (✉)
Arizona State University, T. Denny Sanford School of Social and Family Dynamics, Tempe, AZ, USA
e-mail: tspinrad@asu.edu

N. Eisenberg
Arizona State University, Department of Psychology, Tempe, AZ, USA

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_14

distinguish between empathy and its related emotional responses (i.e., sympathy, personal distress). Empathy is defined as an affective response that stems from the apprehension or comprehension of another's emotional state or condition; it is typically identical or similar to what the other person is feeling (Eisenberg, Fabes, & Spinrad, 2006). For example, if a child feels sadness himself while viewing a sad person, the child is experiencing empathy. Empathy has been differentiated from other emotional responses, including sympathy and personal distress.

Sympathy is an affective response that may stem from empathy, but it also can derive from cognitive processes. Sympathy consists of feeling sorrow or concern for another (rather than feeling the same emotion). Because sympathy is an affective response that also has a cognitive basis, it may stem from perspective taking or other cognitive processes, such as retrieving information from memory about how a person might feel given an emotion-inducing experience. Thus, sympathy frequently stems from empathy, but empathy is not required to experience sympathy. Personal distress also may arise from empathy, but it is a self-focused, aversive emotional reaction, such as feeling discomfort or anxiety upon witnessing another person's distress. Personal distress is exemplified by a child who feels anxious or uncomfortable when confronted with another person's distress and is motivated to escape the presence of the person causing personal distress. We use the term "empathy-related responding" when we wish to refer to the more global response that involves emotion, such as empathy, sympathy, and/or personal distress.

In addition to empathy-related responses, the moral emotion of guilt is reflected in individuals' regret over wrongdoing, and this emotion is thought to be accompanied by the desire to make reparations (Hoffman, 2000). When individuals feel guilty, they are likely to confess or compensate for any misdeeds. Further, because guilt is an unpleasant feeling, people may resist behaving in disruptive ways if they anticipate feeling guilty about it (Eisenberg, Spinrad, & Knafo-Noam, 2015; Kochanska, Barry, Jimenez, Hollatz, & Woodard, 2009; Malti, Gummerum, Keller, & Buchmann, 2009; Malti & Ongley, 2014). In addition, guilt likely sometimes co-occurs with empathy and/or sympathy, or one might induce the other (e.g., Hoffman, 2000).

We, and others, have argued that it is important to distinguish between these emotional responses because empathy and its related emotional responses are thought to be associated with different moral motivations and, consequently, are expected to be differentially related to some morally relevant behaviors, for example, altruistic behavior (Batson, 1998; Eisenberg, 1986; Eisenberg, VanSchyndel, & Spinrad, 2016). Prosocial behavior is defined as voluntary behavior intended to benefit another (Eisenberg, Spinrad, & Knafo-Noam, 2015). Altruisms are those prosocial behaviors that are intended to benefit another rather than performed for self-gain, social approval, or the desire to make oneself feel better. Because sympathy is viewed as an other-oriented response associated with the desire to reduce the other person's distress, it is thought to motivate prosocial behavior, especially altruistic behavior. Empathy is thought to lead to sympathy or personal distress and is not thought to motivate prosocial behavior in itself (although, in some cases, it could). Personal distress reactions are thought to lead to egoistic concerns and the motivation to make oneself, rather than the other person, feel better (Batson, 1991). Thus, personal distress is believed to be associated with escaping contact with the distressed individual, unless escape is not possible and helping is the easiest way to alleviate one's own distress. Because guilt is associated with the desire to make reparations, guilt is thought to be associated with prosocial actions (Hoffman, 2000).

Indeed, researchers have demonstrated the predicted positive associations of prosocial behaviors with sympathy (Malti et al., 2016; Nichols, Svetlova, & Brownell, 2009; Vaish, Carpenter, & Tomasello, 2009; Zahn-Waxler, Robinson & Emde, 1992) and adaptive levels of guilt (Caprara, Barbaranelli, Pastorelli, Cermak, & Rosza, 2001; Chapman, Zahn-Waxler, Cooperman, & Iannotti, 1987; Drummond,

Hammond, Satlof-Bedrick, Waugh, & Brownell, 2017; Gummerum, Hanoch, Keller, Parsons, & Hummel, 2010; Malti & Krettenauer, 2013; Menesini & Camodeca, 2008; Ongley, Nola, & Malti, 2014). Negative relations (or no relations) between personal distress and prosocial behavior also have been demonstrated (see Eisenberg, Spinrad, & Knafo-Noam, 2015).

Note that for the remainder of this chapter, we focus on understanding prosocial emotions, rather than on prosocial behavior.

Prosocial Emotions as Self-Conscious Emotions

We view empathy, sympathy, and guilt as part of a network of self-conscious emotions, rather than as a basic emotion (Lewis, 2002, 2008; Tangney, Stuewig, & Mashek, 2007). In this view, some self-conscious emotions, such as empathy and sympathy, are those that emerge only when children develop an understanding of "self" that is separate from others (Lewis, 1992, 2008), whereas other self-conscious emotions, such as guilt, shame, pride, and embarrassment, develop with the additional awareness of social standards, rules, and goals (Lewis, 1992). Indeed, there is evidence that the emergence of young children's mirror recognition is positively related to empathic responses (Decety & Svetlova, 2012; Bischof-Köhler, 1991; Zahn-Waxler, Radke-Yarrow, Wagner, & Chapman, 1992), suggesting that true empathy and sympathy may require self-representation (see Nichols et al., 2009). In one recent study, college students' empathy was positively associated with more perspective-*shifting* ability (being able to shift from one's own perspective to another's and back to one's own perspective), suggesting that the ability to incorporate another's perspective but also one's own perspective may play an important role in empathy (Chiu & Yeh, 2018). Personal distress, in contrast to sympathy or empathy, may not have the same underlying processes (i.e., self-focused distress or contagious crying may not require self-awareness).

The emotion of guilt (when defined as regret over wrongdoing as opposed to psychoanalytic definitions relating to childhood trauma) has been viewed as a self-conscious *evaluative* emotion. As such, guilt is thought to require an understanding of standards and rules and also a sense of responsibility for a transgression. Lewis (2008) noted that the emotion of guilt is produced when individuals see their behavior as a failure and desire to take corrective action. Thus, guilt is seen as a moral emotion that motivates prosocial or reparative behavior. However, guilt also can be maladaptive when it becomes tied to shame (a more self-destroying intense emotion focused on punishing oneself; Tangney et al., 2007).

Development of Prosocial Emotions

Hoffman (2000) proposed a theoretical model outlining the normative developmental progression of empathy. With increasing cognitive and social skills, such as self-other differentiation and perspective taking, Hoffman proposed that infants shift from more self-focused reactions to other-oriented concern over time. In the first stage, Hoffman argues that infants' reflexive crying in response to the crying of other infants reflects infants' *global empathy*, a precursor of empathic arousal (see, however, Ruffman, Lorimer, & Scarf, 2017). Around the end of the first year of life, infants enter the phase known as *egocentric empathy*, during which infants are thought to experience self-distress and seek comfort for themselves when confronted with another's distress. Because infants lack the ability to differentiate between self and other, their responses to others' distress and their own actual distress are the same.

Sometime during the second year of life, as infants begin to develop self-awareness, toddlers enter the phase known as *quasi-egocentric empathy.* This period reflects the diminishing self-distress reactions in favor of toddlers' empathic concern for another. Although toddlers in this stage may attempt to comfort another person, they may do so in a way that toddlers themselves

find comforting (e.g., bringing their own mother to their distressed or lonely peer).

As children mature cognitively, they move into the phase of *veridical empathic distress*. In this stage, children develop empathic responses to a wider range of emotions than in the previous stage, and prosocial actions reflect children's awareness of the other person's needs. By late childhood, children are able to think abstractly and can experience empathic distress for people who are not physically present and for another's group or life condition (e.g., the oppressed, homeless).

Empirical support for the developmental progression proposed by Hoffman has been mixed. Some researchers question the onset of concern for others (arguing that it occurs earlier than Hoffman proposed) and whether empathy is dependent on self-awareness skills (Davidov, Zahn-Waxler, Roth-Hanania, & Knafo, 2013). For example, Ruffman et al. (2017) questioned the validity of research on contagious crying in newborns, suggesting that findings simply may be due to acoustic characteristics of crying stimuli rather than emotional contagion. Further, Roth-Hanania, Davidov, and Zahn-Waxler (2011) found evidence of affective and cognitive indices of concern for another in the first year of life. As further evidence of the early development of young infants' moral skills, the ability to make judgments about others' moral character has been demonstrated in infants as young as 3 months of age through toddlerhood (Dunfield & Kuhlmeier, 2010; Hamlin & Wynn, 2011; Hamlin, Wynn, Bloom, & Mahajan, 2011; Vaish et al., 2009).

Despite the controversy regarding the initial emergence of empathy in young children, there is support for Hoffman's notion that empathy and sympathy increase with age (Eisenberg & Fabes, 1998; Knafo, Zahn-Waxler, Van Hulle, Robinson, & Rhee, 2008; Volbrecht, Lemery-Chalfant, Aksan, Zahn-Waxler, & Goldsmith, 2007; Zahn-Waxler, Radke-Yarrow et al., 1992; Zahn-Waxler, Schiro, Robinson, Emde, & Schmitz, 2001). In particular, there appears to be significant increases in empathy (including cognitive indices of empathy, such as hypotheses testing) or sympathy in toddlerhood (Knafo et al., 2008; Taylor, Eisenberg, Spinrad, Eggum, & Sulik, 2013; van der Mark, van IJzendoorn, & Bakermans-Kranenburg, 2002) and decreases in personal distress with age (Liew et al., 2011; van der Mark et al., 2002; Zahn-Waxler et al., 2001). Increases in empathy and sympathy continue through childhood and adolescence, although a leveling off or even modest declines in adolescence has been found (Eisenberg, Spinrad, & Knafo-Noam, 2015; Eisenberg, Cumberland, Guthrie, Murphy, & Shepard, 2005; Taylor, Barker, Heavey, & McHale, 2013).

As an alternative to Hoffman's developmental approach, Hay (1994) and Hay et al. (1999) suggested that prosocial action emerges in the second year of life and *declines* thereafter. Although most researchers discussing the development of prosocial emotions have expected an increase with age, Hay and colleagues argued that with age, children begin to show prosocial action toward some, but not all, recipients. That is, children, as they become more regulated, differentiate their prosocial action on the basis of relationships, expectations of reciprocity, and gender. Unfortunately, most research focusing on the development of empathy-related responding has not differentiated among recipients, and most of the support for Hay's model comes from research on sharing, rather than on emotional reactions to others' distress (Hay et al., 1999).

With regard to the development of guilt, Malti (2016) proposed that precursors to guilt (i.e., sadness) emerge in early childhood and that guilt develops, becomes internalized, and increases from early to middle childhood. However, there is very little empirical research on this issue. Researchers have demonstrated that children's negative affect following transgression (the child was led to believe that he/she damaged a valued object) can be identified as early as 17 or 22 months (Barrett, 2005; Kochanska, Gross, Lin, & Nichols, 2002) or around age 2 (Barrett, Zahn-Waxler, & Cole, 1993; Drummond et al., 2017). In one of the few studies to observe young children's responses to wrongdoing longitudinally, Kochanska et al. (2002) showed that from 22 to 45 months, children increased in bodily

tension but decreased in gaze avoidance and distress responses, likely reflecting improvements in self-regulation skills. Mothers' reports of children's guilt appeared to increase from 22 to 56 months of age and corresponded only weakly to children's observed responses at 56 months of age (and not at younger ages). Because researchers studying younger children have generally assessed children's observed responses to transgressions, whereas those studying older children or adolescents have tended to use self-report data, our understanding of the development of guilt is quite limited. Thus, future research on the development of guilt over time requires careful attention to measurement and method effects.

In sum, the development of prosocial emotions is somewhat complex. We expect that self-focused personal distress reactions emerge in infancy and decline with age as children become more regulated and less egocentric, whereas empathy and sympathy emerge in early toddlerhood and increase with age, due to cognitive improvements such as self-other differentiation and abstract thinking or increases in emotional competence (e.g., regulation skills so children do not become overaroused and experience personal distress, capacity to understand emotions). Of note, because both personal distress and sympathy may stem from empathy (as well as other processes), we imagine that there is considerable overlap in their initial developmental trajectories; however, their trajectories might diverge due to the development of self-regulation and individual differences therein. More regulated children might be expected to be relatively prone to sympathy as their regulatory skills consolidate, whereas less regulated children might remain relatively prone to personal distress (Eisenberg, 2010). Empathy may become more common with the development of perspective taking and other cognitive skills, but whether it fosters sympathy or personal distress is likely to vary as a function of the aforementioned individual differences in self-regulation. Finally, because of the required self-evaluation involved in guilt, we expect that this emotion arises later than empathy-related responses (perhaps after 24 months) and increases with age. Moreover, because empathy might often motivate guilt (Hoffman, 2000), especially in the early years (when moral values are unlikely to motive guilt), the early trajectories of empathy and guilt may be similar.

Heritability of Prosocial Emotions

Children's genetic endowment undoubtedly plays a role in children's empathy-related responding and moral emotions. Research on the heritability of empathy and sympathy has demonstrated moderate genetic influence. Using twin-study designs comparing MZ twins (who share all of their genes) and DZ twins (who share, on average, half their genes), researchers have found that empathy and guilt have a moderate genetic basis (Davis, Luce, & Kraus, 1994; Volbrecht et al., 2007; Zahn-Waxler et al., 2001), although the genetic effects appear to change with age. For example, Knafo et al. (2009) reported no effect of heredity on children's empathy in a study of Israeli toddlers from 14 to 20 months, but genetic effects appeared later, when toddlers were 24–36 months (Knafo, Zahn-Waxler, Davidov, Hull, Robinson, & Rhee, 2008). In a meta-analysis of twin studies of empathy, Knafo and Uzefovsky (2013) showed that the hereditability of empathy (which was often measured as sympathy to some degree) increased with age, perhaps because of infants' developing cognitive abilities, increased self-regulation skills (which may be partially genetic), or because of changes in young children's social worlds that expand to include peer groups, as well as family members (Knafo & Uzefovsky, 2013).

Another major approach to studying genetic influences on prosocial emotions is the molecular genetic approach, with researchers focusing mainly on dopamine and oxytocin activity. The human dopamine receptor D4 (DRD4) appears to be associated with empathy in adults (Uzefovsky et al., 2014) and to predict emotion knowledge (a skill related to cognitive empathy) in children (Ben-Israel, Uzefovsky, Ebstein, & Knafo-Noam, 2015). In addition, the oxytocin receptor gene (OXTR) has been associated with empathy in adults (Christ, Carlo, & Stoltenberg, 2016; Gong

et al., 2017; Rodrigues, Saslow, Garcia, John, & Keltner, 2009; Uzefovsky et al., 2015; Wu, Li, & Su, 2012) and 18-month-olds' social cognition (a composite including observed empathy, Wade, Hoffmann, Wigg, & Jenkins, 2014). However, the study of the role of genetics (especially molecular genetics) in empathy-related responding and guilt is in its infancy, and there is much more to be learned about genes and prosocial emotion, the genetic origins of guilt, and the potential interactive effects of genetics with environment influences (see below).

Parental Socialization of Prosocial Emotions

In addition to understanding the role of genetics in empathy-related responding and guilt, environmental factors, particularly parents' role in the socialization of children's prosocial emotions, have been a topic of considerable interest. Relevant research on the socialization of empathy-related responding and guilt has focused on a number of parenting behaviors. In this section, we focus on parental warmth/support, discipline strategies, and emotion-related socialization strategies.

Warmth/Support

Parental warmth and support are thought to promote children's empathy-related responding because such characteristics are believed to foster positive parent-child relationships and responsiveness to parental socialization efforts. Further, warmth and supportive parenting may serve as a model for sympathy toward others. Parental warmth and support have been positively related to children's sympathy (Laible & Carlo, 2004; Malti, Eisenberg, Kim, & Buchmann, 2013; Spinrad et al., 1999). In a long-term longitudinal study, Eisenberg, VanSchyndel, and Hofer (2015) found that mothers' warmth in childhood predicted sympathy in adulthood.

Maternal sensitivity and responsiveness, constructs similar to warmth that reflect sensitive, child-centered parenting, also have been associated with children's sympathy (Davidov & Grusec, 2006; Feldman, 2007a, 2007b; Kiang, Moreno, & Robinson, 2004; Moreno, Klute, & Robinson, 2008; Spinrad & Stifter, 2006; Tong et al., 2012) and guilt (Kochanska et al., 2002; Kochanska, Forman, Aksan, & Dunbar, 2005). For example, a mother-child mutually responsive orientation (a construct that encompassed both maternal responsiveness and shared positivity) when children were 9–22 months of age predicted children's relatively high guilt reactions in response to transgression (breaking someone's valuable possession) at 45 months of age (Kochanska et al., 2005).

Because responsiveness and warmth are thought to predict high-quality parent-child relationships, researchers have examined whether security of the mother-child attachment is an important antecedent for the emergence of children's caring for others (see Stern & Cassidy, 2017). Attachment security has been linked with children's and adolescents' empathy or sympathy (Diamond, Fagundes, & Butterworth, 2012; Kim & Kochanska, 2017; Murphy & Laible, 2013; Nickerson, Mele, & Princiotta, 2008; van der Mark et al., 2002) and conscience/guilt (Kochanska, 1995; Kochanska, Aksan, Knaack, & Rhines, 2004). Stern and Cassidy (2017), in a review, noted some inconsistencies in the prior relation. They found that a slight majority of the studies reviewed reported positive relations between attachment and empathy and none reported negative associations, but many reported null effects or conditional effects. In general, the evidence of a relation was weakest in infancy (perhaps because empathy and sympathy are still developing in this period) and generally positive in the toddler years when both attachment security and empathy are developed. The relation is unclear in middle childhood due to lack of research examining the relation of attachment and empathy during this developmental period, whereas the relation has been consistently positive in adolescence. If this relation is found to be increasingly positive with age, it could be partly due to the relation of attachment to the development of self-regulation (Pallini et al., 2018) and

the role of self-regulation in sympathy (Eisenberg, 2010). Moreover, some of the age effects could be due to the fact that researchers use cross-sectional designs and utilize different methods to assess empathy-related responding at different ages (i.e., self-reports in adolescent research) and operationalize empathy-related responding in different ways (e.g., sometimes as empathy and sometimes as sympathy). Thus, there is a need for more longitudinal research with a variety of (and multiple) methodologies.

Parental Discipline

Hoffman (2000) described how disciplinary practices serve to promote children's empathy-related responding and guilt. That is, disciplinary practices that induce enough arousal to elicit the child's attention but are unlikely to produce high levels of anxiety or anger are optimal strategies for the child to process the parent's message. When parents use strategies that overarouse children, it is likely that children experience self-focused reactions. Parental induction reflects parents' attempts to guide behavior through explanations, reasoning, and focusing on the causes and consequences of behaviors, and this disciplinary strategy is thought to generate the optimal level of arousal for learning.

Researchers have frequently reported support for the association between parents' use of inductive discipline and children's empathy-related responding (Carlo, Knight, McGinley, & Hayes, 2011; Carlo, McGinley, Hayes, Batenhorst, & Wilkinson, 2007; Eisenberg, VanSchyndel, & Hofer, 2015; Farrant, Devine, Maybery, & Fletcher, 2012; Guevara, Cabrera, Gonzalez, & Devis, 2015; Laible, Eye, & Carlo, 2008). In contrast, parental strategies that are harsh or punitive tend to be negatively related to empathy and sympathy (Cornell & Frick, 2007; Hastings, Zahn-Waxler, Robinson, Usher, & Bridges, 2000: Laible et al., 2008). Maternal power-assertive practices also have been shown to be inversely related to children's guilt in response to wrongdoing (Kochanska et al., 2002). Further, when considering both parents' style of discipline, Garner (2012) found that maternal power assertion was negatively related to children's sympathy only at high levels of paternal power assertion, suggesting that children are at greater risk for low sympathy when they receive harsh discipline from both parents (also see Laible & Carlo, 2004).

Emotion-Related Socialization Practices

Studies on the relations of parents' emotion-related socialization practices to children's prosocial emotions are limited in number. However, parental practices that help children adaptively cope with their negative emotions are thought to be optimal strategies to constructively manage their arousal when confronted with another's distress.

One way in which parents socialize their children's emotions is through their own expression of positive and negative emotions (Eisenberg, Cumberland, & Spinrad, 1998). Parents' emotional expressivity involves the display of either positive, negative-dominant (i.e., anger, hostility), or negative-submissive (i.e., sadness, crying) emotions. Negative motional expressivity (particularly hostile emotions, such as anger) is thought to be negatively related to empathy-related responses because such expressions may be viewed as overarousing to children. In fact, mothers' negative expressivity has been empirically related to relatively low empathy or sympathy in childhood (Batanova & Loukas, 2012; Denham & Grout, 1992; Eisenberg, Liew, & Pidada, 2001; Spinrad et al., 1999; Valiente et al., 2004; Zhou et al., 2002). Mothers' positive emotionality has sometimes been associated with relatively high empathy or sympathy (Eisenberg et al., 1991; Eisenberg & McNally, 1993; Garner, Jones, & Miner, 1994; Zhou et al., 2002) and low personal distress (Eisenberg & McNally, 1993).

In addition to parental expressions of emotions, parents' responses to their children's emotions may teach children appropriate ways to cope with their negative feelings and in turn, protect against children's tendencies to become

overaroused; limited evidence supports this perspective (see Eisenberg, Cumberland, & Spinrad, 1998; Eisenberg, Spinrad, & Knafo-Noam, 2015). Indeed, researchers have demonstrated that parents who appropriately respond to their children's emotions have children who are well-regulated (Spinrad et al., 2007; Valiente, Lemery-Chalfant, & Reiser, 2007). In addition, when parents encourage their children to express emotions, children may be more likely to understand their own and others' feelings. In one longitudinal study, mothers who encouraged their toddlers to express their emotions at 18 months of age had children were relatively high in empathy 6 months later (Taylor, Eisenberg, Spinrad, Eggum, & Sulik, 2013).

Another way in which parents socialize their children's emotions involves parental discussion of emotion. Parents who discuss their own and others' emotions tend to have children who show higher empathy-related responding (Brownell, Svetlova, Anderson, Nichols, & Drummond, 2013; Garner, Dunsmore, & Southam-Gerrow, 2008). Little is known about how parents' discussion of emotion relates to children's guilt/conscience development.

Other aspects of parenting not discussed above, such as use of rewards and modeling, have also been associated with children's prosocial emotions (see Eisenberg, Spinrad, & Knafo-Noam, 2015). Further, we acknowledge that although it is often assumed that parents socialize children's prosocial emotions, it is likely that children's earlier prosocial emotions predict parents' subsequent socialization practices. As one case in point, Padilla-Walker, Carlo, Christensen, and Yorgason (2012) reported transactional relations between adolescents' prosociality on later authoritative parenting, as well as authoritative mothering predicting later adolescents' observed prosocial behavior toward their mothers. Given the relations of empathy-related responding and guilt to children's prosocial behavior, these results provide some indirect support for the notion that there may be reciprocal effects between parents' socialization efforts and children's prosocial emotions.

Sociocognitive Skills

Consistent with Hoffman's theory, the development of children's sociocognitive skills is thought to contribute to children's prosocial emotions. As discussed previously, mirror self-recognition has been associated with empathy-related outcomes (Nichols et al., 2009) but there is some debate regarding whether such skills are a necessary prerequisite for other-oriented emotions (see Davidov et al., 2013). Because we think of prosocial emotions as self-conscious emotions, we argue that individuals who understand others' perspectives, desires, and emotions should be more likely to infer when another person is needy or distressed. Such individuals are thought to be able to differentiate between their own and others' emotional reactions and would be more likely to experience empathy, sympathy, and guilt.

Indeed, researchers have demonstrated positive relations between general perspective- taking skills and children's empathy or sympathy (Batanova & Loukas, 2012; Eisenberg, Zhou, & Koller, 2001; Espelage, Green, & Polanin, 2012; Roberts & Strayer, 1996; Silfver & Helkama, 2007; Strayer & Roberts, 1989). Using an experimental design, Vaish et al. (2009) found that toddlers showed more concern toward an adult who had been harmed but showed no emotion than toward an unharmed adult, indicating that toddlers' perspective-taking skills (putting oneself in the other's shoes) contribute to their sympathy for the victim. Further, the findings indicate that sympathy is not simply a function of emotional contagion. Toddlers are more likely to experience sympathy when the other's distress was justified as opposed to unjustified (Hepach, Vaish, & Tomasello, 2012). Consistent with Hoffman's theory, perspective-taking skills have also been positively related to children's guilt over transgressions, particularly for boys (Silfver & Helkama, 2007).

In addition to general perspective-taking skills, it stands to reason that young children's ability to recognize and detect emotions, understanding the situations that elicit emotions as

well as affective perspective taking, might facilitate children's empathy. That is, when individuals understand others' emotions, they should be more likely to experience another's feelings. Results from a number of studies support a positive relation between emotion knowledge and children's empathy or sympathy (Eggum et al., 2011; Garner, 2003) or prosocial behavior (Denham, 1986; Ensor & Hughes, 2005; Ensor, Spencer, & Hughes, 2011; Garner, Jones, & Palmer, 1994; Knafo, Steinberg, & Goldner, 2011). In two studies, toddlers' use of emotion words or internal state language (an index of emotion understanding) was positively related to various measures of sympathy (Garner, 2003; Nichols et al., 2009) but was unrelated to observed empathy-based guilt reactions (Garner, 2003). Further, emotion understanding measured by assessing children's affective labeling and affective perspective taking has been shown to predict child-reported sympathy over time (Eggum et al., 2011). Thus, emotion knowledge likely contributes to some measures of children's concern toward others' distress, although perhaps not in response to moral transgressions.

A related sociocognitive ability thought to relate to prosocial emotions is children's theory of mind. Theory of mind refers to the ability to understand others' mental states, beliefs, thoughts, intentions, and desires. By preschool age, children begin to understand that individuals can have incorrect assumptions about reality (i.e., false beliefs), and there is a great deal of growth in the development of theory of mind during the preschool years (Wellman, Cross, & Watson, 2001; Yagmurlu, 2014). It is assumed that children who have developed an understanding of theory of mind would be better able to interpret others' cues and understand their goals and desires; thus, it is likely that such skills would be positively related to children's empathy, sympathy, and/or guilt. Research evidence supports this notion. In one study, children's false belief understanding was positively related to adult-reported prosocial orientation (a composite including empathy, sympathy, and prosocial behavior), both concurrently and over time (Eggum et al., 2011). Researchers also found that theory of mind development was associated with guilt responses, such that more sophisticated theory of mind was related to judging accidental transgressions less negatively than intentional transgressions (Killen, Mulvey, Richardson, Jampol, & Woodward, 2011). Despite some evidence for the associations between children's theory of mind and prosocial emotions, many of the relevant studies examine children's prosocial behavior or general social competence rather than prosocial emotions per se (Caputi, Lecce, Pagnin, & Banerjee, 2012); thus, more work in this area is needed.

Finally, children's prosocial moral reasoning about dilemmas involving helping or sharing behavior is thought to not only reflect age-related changes in cognition, but also to vary as a function of prosocial emotions, particularly sympathy (Eisenberg, 1986). That is, feelings of concern for others may motivate other-oriented moral judgments. Researchers have shown that children's higher prosocial moral reasoning is positively associated with children's sympathy (Carlo, Mestre, Samper, Tur, & Armenta, 2010; Eisenberg et al., 2002; Eisenberg, Hofer, Sulik, & Liew, 2014; Eisenberg, Zhou, & Koller, 2001; Miller, Eisenberg, Fabes, & Shell, 1996; Ongley et al., 2014). It is possible that empathy or sympathy motivates prosocial moral reasoning, especially when examined in the same context; for example, other-oriented emotions such as sympathy may be linked to other-oriented cognitions and moral judgments in cognitive networks and may prime other-oriented moral reasoning. Conversely, moral reasoning sometimes might promote feelings of sympathy or empathy, perhaps especially over time, if other-oriented moral judgments foster a focus on others' needs and feelings. It is also thought that guilt feelings serve important moral functions that are associated with more sophisticated other-oriented moral reasoning (Malti, Gasser, & Gutzwiller-Helfenfinger, 2010; Malti & Ongley, 2014).

Relations of Prosocial Emotions to Temperamental Characteristics

Children's dispositional characteristics also have been implicated in children's prosocial emotions. Specifically, we focus on two major components of temperament, emotionality and regulation (Rothbart & Bates, 2006). We also consider children's shyness or inhibition, which likely have a temperamental basis (see Kagan & Fox, 2006), as important predictors of children's empathy-related responses and guilt.

Emotionality

Because empathy-related responses involve vicarious emotional responding, it is not surprising that children's proneness to experience negative emotions is relevant to their prosocial emotions. The tendency for individuals to become overaroused, especially if they cannot regulate these emotions, would be expected to be associated with personal distress reactions and perhaps guilt responses, whereas children who tend to experience low levels of negative emotional intensity (or well-regulated emotions) are expected to experience optimal levels of empathy and especially sympathy. Indeed, children's negative emotionality has been positively related to personal distress reactions (Eisenberg et al., 1994; Guthrie et al., 1997) and negatively related to dispositional sympathy (Bandstra, Chambers, McGrath, & Moore, 2011; Carlo, Crockett, Wolff, & Beal, 2012; Eisenberg et al., 1996; Eisenberg, Fabes, et al., 1998; Murphy, Shepard, Eisenberg, Fabes, & Guthrie, 1999; Robinson, Zahn-Waxler, & Emde, 1994). Further, adolescents who reported that they were prone to negative affect also appear prone to experiencing guilt (Caprara et al., 2001; Rothbart, Ahadi, & Hershey, 1994). Thus, children who experience negative emotions may experience distress at wrongdoing, but this guilt is likely adaptive to an extent for motivating reparations. However, it is important to acknowledge that not all guilt is adaptive, and a more nuanced view of the relations of negative emotionality to guilt is needed, such as considering quadratic relations. In other words, excessive guilt may reflect or be manifest as clinical internalizing problems (Tone & Tully, 2014).

Although it is expected that general negative emotionality would be associated with lower sympathy (and sometimes empathy), children who are prone to the specific negative emotion of sadness may be particularly responsive to others' distress. In one study, Edwards et al. (2015) found that sadness was unrelated to sympathy for 18-month-old toddlers and was negatively related a year later. However, the relation between sadness and sympathy was positive by 42 months of age (albeit marginally significant), suggesting that as children gain sociocognitive skills, their own sadness might increase their sympathy and responsiveness to another person's sadness. That is, in toddlerhood, dispositional sadness might be related to overarousal rather than sympathy; however, as children gain in the ability to put oneself in another person's shoes, children's own proneness to sadness may support their ability to understand and share the others' sadness and feel sorrow for another.

As opposed to sadness, children's anger is likely to be negatively related to children's prosocial emotions because anger is thought to represent dysregulation and has been found to predict antisocial behaviors such as aggression (Eisenberg, Cumberland, et al., 2001; Frick & Morris, 2004). In a number of studies, anger has been negatively related to children's empathy-related responding (Carlo, Roesch, & Melby, 1998; Colasante, Zuffianò, & Malti, 2015; Roberts & Strayer, 1996; Roberts, Strayer, & Denham, 2014; Strayer & Roberts, 2004). However, positive relations have also been found between anger and young schoolchildren's empathy or guilt (Rothbart et al., 1994). It is possible that compassionate individuals could feel empathic anger or moral outrage (Batson, Chao, & Givens, 2009) or that people prone to general emotionality tend to be prone to high levels of guilt and anger.

In terms of positive emotionality, Fredrickson's broaden-and-build theory suggests that positive emotions broaden individuals' thought-action tendencies and build their resources (Fredrickson,

2001). Positive emotions are thought to build children's social resources and competent social interactions with others (see Eisenberg & Fabes, 1991). Thus, it is possible that positive emotions predispose individuals for empathy and sympathetic responsiveness to others. Indeed, children's temperamental positive emotionality has been associated with relatively high empathy or sympathy (Eisenberg, Fabes, Murphy, et al., 1996; Lengua, 2003; Oberle, Schonert-Reichl, & Thomson, 2010; Rothbart et al., 1994) and positive empathy (feelings of happiness upon observing another's joy; Sallquist, Eisenberg, Spinrad, Eggum, & Gaertner, 2009). Observed positive affect during mishaps was negatively related to other indicators of guilt in one study (Kochanska et al., 2002); however, little is known about the relations between dispositional positive emotionality and children's guilt responses (although smiling was nonsignificantly negatively related to guilt and empathy in one study; Rothbart et al., 1994).

Self-Regulatory Skills

We would expect that children who can regulate their emotional experiences would be unlikely to become overaroused by another's distress. In contrast, children who have difficulty regulating their arousal would be expected to be prone to self-focused distress reactions, especially if they are prone to be emotional. Empirical work supports this notion; researchers have demonstrated dispositional self-regulation or effortful control to be positively related to empathy or sympathy (Eisenberg, Fabes, Karbon, et al., 1996; Eisenberg et al., 2007; Guthrie et al., 1997; Ladd & Profilet, 1996; Murphy et al., 1999; Padilla-Walker & Christensen, 2011; Panfile & Laible, 2012; Rothbart et al., 1994) and reparation after wrongdoing or guilt (Colasante, Zuffianò, Bae, & Malti, 2014; Kochanska et al., 2009; Kochanska, DeVet, Goldman, Murray, & Putnam, 1994; Kochanska & Knaack, 2003). Low self-regulatory skills have been shown to predict children's relatively high personal distress reactions (Eisenberg, Fabes, et al., 1998; Eisenberg, Fabes, Karbon, et al., 1996; Geangu, Benga, Stahl, & Striano, 2011; Guthrie et al., 1997; Valiente et al., 2004). Similar to regulation, ego resiliency, reflecting individuals' ability to bounce back and manage their emotions under stress or uncertainty (Block & Block, 1980; Taylor, Eisenberg, Spinrad, & Widaman, 2013), has been positively related to empathy or sympathy (Strayer & Roberts, 1989; Taylor, Eisenberg, Spinrad, Eggum & Sulik, 2013).

Physiological measures also have been used to examine the association between self-regulation and empathy-related responding. Vagal tone or respiratory sinus arrhythmia (RSA, a measure reflecting physiological regulatory skills) has been positively related to empathy and sympathy (Diamond et al., 2012; Liew et al., 2011; Song, Colasante, & Malti, 2017; Taylor, Eisenberg, & Spinrad, 2015). In addition, RSA suppression has been negatively related to toddlers' comfort seeking (thought to be a measure of personal distress) at 18 and 30 months (Liew et al., 2011). However, Miller, Kahle, and Hastings (2017) found that the relation of vagal tone to empathic concern and prosocial behavior may actually be quadratic, such that the association of vagal tone to empathic concern and prosociality follows an inverted U-shaped pattern. They suggested that in early childhood moderate vagal tone may reflect an optimal balance of regulation and arousal that foster sympathy and sharing.

Shyness/Inhibition

Children who are prone to reacting negatively to social stimuli or novelty may have difficulty expressing concern for others—especially people they do not know well—because they may feel overaroused or seek comfort for themselves when confronted with others' distress. Thus, children who are shy (inhibited in regard to approach in social contexts) and those who are behaviorally inhibited (reactive toward novel objects, people, and situations) may be prone to personal distress because they are overaroused in these contexts. A related and broader construct, fearfulness, is a negative response to threat and would also be

expected to predict increased personal distress responses.

Indeed, empirical evidence has shown that inhibited or fearful children are more likely to experience personal distress reactions in response to another's distress (Eisenberg, Spinrad, Taylor, & Liew, 2017; Liew et al., 2011; Spinrad & Stifter, 2006). However, the relation of inhibition or fear to children's empathy or sympathy has been somewhat mixed. Some researchers have found that shyness, behavioral inhibition, or fear predicts less empathy or sympathy (Eisenberg, Fabes, Karbon, et al., 1996; Van der mark et al., 2002; Young, Fox, & Zahn-Waxler, 1999). In contrast, others have shown unexpected positive relations between fear and concern toward a distressed stranger (Spinrad & Stifter, 2006). The authors speculated that fearful infants may have been more attuned to another's distress or may have fixated on the distressed person (and were unable to avert their gaze from the distressed person). In the latter case, behavior that was seen as concerned attention actually may have been involuntary behavior (i.e., freezing) indicative of personal distress. More work should be done to understand the relations of fear or inhibition to children's empathy and sympathy.

In terms of guilt, shy or inhibited children may be particularly motivated to avoid the feelings of discomfort they might feel following wrongdoing. That is, such children would be expected to experience greater anxious arousal during transgressions, which, in turn, promotes reparative behaviors. The hypothesized positive relations between behavioral inhibition/fear and guilt or conscience development has been supported (Kochanska, 1995; Kochanska et al., 2002; Kochanska, Coy, & Murray, 2001; Rothbart et al., 1994). For example, Kochanska et al. (2002) found that fearful children tended to experience more guilt longitudinally. In another study, fear in infancy (before guilt had developed) was found to predict guilt in response to mishap 2 years later (Baker, Baibazarova, Ktistaki, Shelton, & Van Goozen, 2012). These findings provide evidence that fearful inhibition may facilitate feelings of discomfort when viewing others' distress or when transgressing or breaking a rule. Thus, it appears that children's behavioral inhibition may predispose children to arousal in these contexts.

It is important to consider additional complexities in the relations of negative emotionality, self-regulation, and shyness/inhibition to children's prosocial emotions. Eisenberg et al. (1994) suggested that individuals who tend to experience frequent and intense emotions and who are unable to regulate such arousal would be prone to personal distress reactions, whereas when they are prone to experience negative emotions but are able to regulate their emotions, they would be expected to experience sympathy rather than personal distress reactions. In fact, interactions of the aforementioned nature between emotionality and regulation when predicting sympathy have been found; children high in general dispositional emotionality and self-regulation appear especially prone to dispositional sympathy (Eisenberg, Fabes, et al., 1998; Eisenberg, Fabes, Karbon, et al., 1996). Moreover, interactions among behavioral inhibition and self-regulatory skills when predicting empathy also have been obtained; specifically, Stifter, Cipriano, Conway, and Kelleher (2009) found that inhibited toddlers with high executive functioning skills reported less intense emotional reactions to an evocative film, but this relation was not evident for their low reactive or exuberant peers.

In general, temperamental characteristics have been related to children's empathy-related responding and guilt. Current research on the role of temperamental emotionality, regulation, and shyness/inhibition indicates that some temperamental traits are likely to predict personal distress reactions (i.e., high negative reactivity, inhibition/shyness, low regulation), whereas other characteristics are likely to predict sympathy, empathy, and adaptive guilt. The current work is still limited in that researchers tend not to differentiate between various negative emotions nor consistently examine curvilinear relations.

The Mediating and Moderating Effects of Temperamental Characteristics on the Relations of Socialization Variables to Prosocial Emotions

Researchers have emphasized the importance of examining the processes that account for variations across individuals in empathy-related responding and guilt (see Eisenberg et al., 2006; Eisenberg, Spinrad, & Knafo-Noam, 2015). In addition, investigators have discussed and tested factors that might mediate the relations of socialization to moral emotions. For example, one potential mechanism through which parenting is thought to be linked to prosocial emotions is though children's self-regulatory abilities (see Eisenberg, Fabes et al., 1998). Consistent with this view, researchers have found that various aspects of self-regulation mediate the relation between aspects of parenting and children's empathy-related responding or guilt (Eisenberg, Liew, & Pidada, 2001; Panfile & Laible, 2012, Taylor et al., 2015). For example, Taylor et al. (2015) found that authoritative parenting, a style of parenting characterized by appropriate limit setting and warmth, was positively related to children's sympathy through its relation to children's self-regulation.

Further, socialization efforts may be more strongly related to outcomes for some children than others. Research evidence points to interactions between temperamental characteristics and maternal socialization efforts when predicting prosocial emotions. For example, Valiente et al. (2004) found that children's regulation (i.e., effortful control) moderated the effect of parents' negative emotionality on children's personal distress reactions. Specifically, when children's effortful control was moderate or low, children tended to express high levels of personal distress, regardless of parents' negative emotionality. However, when children were well-regulated, there was a positive relation between parents' expression of negativity and children's personal distress reactions. In understanding children's guilt and conscience, Kochanska and colleagues found that maternal gentle control predicted higher internalization of values/guilt for children who were temperamentally fearful, but not for children low in fearfulness (Kochanska, 1991; Kochanska, Aksan, & Joy, 2007). Cornell and Frick (2007) also reported an interaction between behavioral inhibition and inconsistent parenting predicting parent-reported guilt and empathy, such that for inhibited children, guilt was high regardless of parenting; however, for uninhibited children, inconsistent parenting negatively predicted both guilt and empathy.

Recently, investigators have studied the interaction between molecular genetic markers and socialization efforts when predicting moral emotions. Knafo and Uzefovsky (2013) found that among individuals with the DRD4-III 7 repeat allele, but not among other individuals, a negative relation between maternal negativity and preschoolers' empathy was found. In another study examining oxytocin polymorphisms, McDonald, Baker, and Messinger (2016) reported that preschool children's empathy was positively associated with early supportive parent-child interactions only for those with more genetic "risk" (e.g., the GG rs53576 genotype). Moreover, Kochanska, Kim, Barry, and Philibert (2011) found that maternal responsiveness positively predicted children's moral internalization (a composite that reflected empathy, guilt, and moral self) for children who carried a short allele (genetic risk) in the serotonin transporter promoter gene (5-HTTLPR) but not for those without genetic risk. These findings support the differential susceptibility model (Belsky & Pluess, 2009), suggesting that children who carry more vulnerable genes fare worse than their peers if their mothers are unresponsive but fare better when they have a history of responsive caregiving. Research on gene by environment interactions is still in its infancy; we expect that more developments in this area will continue in the coming years.

Conclusions and Future Directions

The research reviewed is only a sample of the extensive body of work on children's prosocial emotions. Although we emphasized a number of individual characteristics and socialization practices that predict individual differences in empathy-related responding and guilt, other factors (e.g., culture, schools, self-awareness) have been implicated in other works. Further, the existing evidence, because it is all essentially correlational (even if longitudinal), does not provide a firm basis for testing assumptions of causation. Randomly assigned experimental intervention programs targeting how adults could scaffold sympathy and kindness are needed. Understanding the mechanisms involved in effective interventions is also a key area for further research.

There are also methodological issues to consider when evaluating current research on prosocial emotions. A multi-method approach is important and necessary for future work in this area because different methods may address somewhat different questions or may not differentiate between different prosocial emotions, and all methods have some limitations. Further, findings do not always converge across different methods. Moreover, some types of methods to study empathy-related responding and guilt tend to be used at certain ages of children (i.e., observational at younger, but not older ages), and this issue may limit researchers' ability to understand the development of these constructs over time.

Another area for future research is work addressing individual differences in children's tendencies to experience empathy or sympathy toward different recipients. For example, researchers have shown that young children tend to show more concern toward their distressed mother versus an unfamiliar adult (Kiang et al., 2004; Robinson et al., 2001; Young et al., 1999; Zahn-Waxler, Radke-Yarrow et al., 1992). A focus on children's concern toward different recipients who are similar (i.e., ingroup) versus less similar (i.e., outgroups) is rare but needed. In one study, 5- to 13-year-olds reported that other children feel more positive about, and more obligated to help, members of their racial ingroup than outgroup (Weller & Lagattuta, 2013). Further, lack of empathic concern is thought to underlie the development of prejudice; in a study of Swedish adolescents, empathic concern predicted lower anti-immigrant attitudes over time (in between-person but not within-person analyses; Miklikowska, 2018). Understanding the factors that account for individual differences in sympathy toward a broader slice of humanity rather than focusing on known peers, family members, or people in one's own group would be of value.

Further, we urge researchers to consider different types of empathy and guilt. For example, it is likely that excessive or pathological guilt (such as guilt directed at oneself) and/or pathological empathy leads to poor outcomes (Eisenberg & Spinrad, 2014; Van Lissa, Hawk, Koot, Branje, & Meeus, 2017). A lack of guilt and empathy also is problematic and predictive of problem behaviors (de Wied, van Boxtel, Matthys, & Meeus, 2012; Frick & White, 2008). Thus, researchers could focus on understanding the predictors of adaptive and maladaptive forms of empathy and guilt (Malti, 2016). Nonlinear relations should also be examined; for example, moderate levels of guilt and empathy (rather than overarousal) might often predict optimal outcomes better than high levels of guilt and empathy. Researchers would be wise to continue to pay attention to nuances in children's prosocial emotions and differentiate between the emotions that are self- and other-focused in order to understand children's motivations for prosocial behaviors.

References

Baker, E., Baibazarova, E., Ktistaki, G., Shelton, K. H., & van Goozen, S. H. M. (2012). Development of fear and guilt in young children: Stability over time and relations with psychology. *Development and Psychopathology, 24*(3), 833–845. https://doi.org/10.1017/S0954579412000399

Bandstra, N. F., Chambers, C. T., McGrath, P. J., & Moore, C. (2011). The behavioural expression of empathy to others' pain versus others' sadness in young children. *Pain, 152*(5), 1074–1082. https://doi.org/10.1016/j.pain.2011.01.024

Barrett, K. C. (2005). The origins of social emotions and self-regulation in toddlerhood: New evidence. *Cognition and Emotion, 19*(7), 953–979. https://doi.org/10.1080/02699930500172515

Barrett, K. C., Zahn-Waxler, C., & Cole, P. M. (1993). Avoiders vs. amenders: Implications for the investigation of guilt and shame during toddlerhood? *Cognition and Emotion, 7*(6), 481–505. https://doi.org/10.1080/02699939308409201

Batanova, M. D., & Loukas, A. (2012). What are the unique and interacting contributions of school and family factors to early adolescents' empathic concern and perspective taking? *Journal of Youth and Adolescence, 41*(10), 1382–1391. https://doi.org/10.1007/s10964-012-9768-5

Batson, C. D. (1991). *The altruism question: Toward a social-psychological answer*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Batson, C. D. (1998). Altruism and prosocial behavior. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (Vol. 1–2, 4th ed., pp. 282–316). New York, NY: McGraw-Hill.

Batson, C. D., Chao, M. C., & Givens, J. M. (2009). Pursuing moral outrage: Anger at torture. *Journal of Experimental Social Psychology, 45*(1), 155–160. https://doi.org/10.1016/j.jesp.2008.07.017

Belsky, J., & Pluess, M. (2009). Beyond diathesis stress: Differential susceptibility to environmental influences. *Psychological Bulletin, 135*(6), 885–908. https://doi.org/10.1037/a0017376

Ben-Israel, S., Uzefovsky, F., Ebstein, R. P., & Knafo-Noam, A. (2015). Dopamine D4 receptor polymorphism and sex interact to predict children's affective knowledge. *Frontiers in Psychology, 6*, 12.

Bischof-Köhler, D. (1991). *The development of empathy in infants* (pp. 245–273). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Block, J. H., & Block, J. (1980). The role of ego-control and ego-resiliency in the organization of behavior. In W. A. Collins (Ed.), *Minnesota symposia on child psychology* (Vol. 13, pp. 39–101). Hillsdale, NJ: Erlbaum.

Brownell, C. A., Svetlova, M., Anderson, R., Nichols, S. R., & Drummond, J. (2013). Socialization of early prosocial behavior: Parents' talk about emotions is associated with sharing and helping in toddlers. *Infancy, 18*(1), 91–119. https://doi.org/10.1111/j.1532-7078.2012.00125.x

Caprara, G. V., Barbaranelli, C., Pastorelli, C., Cermak, I., & Rosza, S. (2001). Facing guilt: Role of negative affectivity, need for reparation, and fear of punishment in leading to prosocial behaviour and aggression. *European Journal of Personality, 15*(3), 219–237. https://doi.org/10.1002/per.402

Caputi, M., Lecce, S., Pagnin, A., & Banerjee, R. (2012). Longitudinal effects of theory of mind on later peer relations: The role of prosocial behavior. *Developmental Psychology, 48*(1), 257–270. https://doi.org/10.1037/a0025402

Carlo, G., Crockett, L. J., Wolff, J. M., & Beal, S. J. (2012). The role of emotional reactivity, self-regulation, and puberty in adolescents' prosocial behaviors. *Social Development, 21*(4), 667–685. https://doi.org/10.1111/j.1467-9507.2012.00660.x

Carlo, G., Knight, G. P., McGinley, M., & Hayes, R. (2011). The roles of parental inductions, moral emotions, and moral cognitions in prosocial tendencies among Mexican American and European American early adolescents. *The Journal of Early Adolescence, 31*(6), 757–781. https://doi.org/10.1177/0272431610373100

Carlo, G., McGinley, M., Hayes, R., Batenhorst, C., & Wilkinson, J. (2007). Parenting styles or practices? Parenting, sympathy, and prosocial behaviors among adolescents. *The Journal of Genetic Psychology: Research and Theory on Human Development, 168*(2), 147–176. https://doi.org/10.3200/GNTP.168.2.147-176

Carlo, G., Mestre, M. V., Samper, P., Tur, A., & Armenta, B. E. (2010). Feelings or cognitions? Moral cognitions and emotions as longitudinal predictors of prosocial and aggressive behaviors. *Personality and Individual Differences, 48*(8), 872–877. https://doi.org/10.1016/j.paid.2010.02.010

Carlo, G., Roesch, S. C., & Melby, J. (1998). The multiplicative relations of parenting and temperament to prosocial and antisocial behaviors in adolescence. *The Journal of Early Adolescence, 18*(3), 266–290. https://doi.org/10.1177/0272431698018003003

Chapman, M., Zahn-Waxler, C., Cooperman, G., & Iannotti, R. (1987). Empathy and responsibility in the motivation of children's helping. *Developmental Psychology, 23*(1), 140–145. https://doi.org/10.1037/0012-1649.23.1.140

Chiu, C., & Yeh, Y. (2018). In your shoes or mine? Shifting from other to self perspective is vital for emotional empathy. *Emotion, 18*(1), 39–45. https://doi.org/10.1037/emo0000346

Christ, C. C., Carlo, G., & Stoltenberg, S. F. (2016). Oxytocin receptor (OXTR) single nucleotide polymorphisms indirectly predict prosocial behavior through perspective taking and empathic concern. *Journal of Personality, 84*(2), 204–213. https://doi.org/10.1111/jopy.12152

Colasante, T., Zuffianò, A., Bae, N. Y., & Malti, T. (2014). Inhibitory control and moral emotions: Relations to reparation in early and middle childhood. *The Journal of Genetic Psychology: Research and Theory on Human Development, 175*(6), 511–527. https://doi.org/10.1080/00221325.2014.976535

Colasante, T., Zuffianò, A., & Malti, T. (2015). Do moral emotions buffer the anger-aggression link in children and adolescents? *Journal of Applied Developmental Psychology, 41*, 1–7. https://doi.org/10.1016/j.appdev.2015.06.001

Cornell, A. H., & Frick, P. J. (2007). The moderating effects of parenting styles in the association between behavioral inhibition and parent-reported guilt and empathy in preschool children. *Journal of Clinical Child and Adolescent Psychology, 36*(3), 305–318. https://doi.org/10.1080/15374410701444181

de Wied, M., van Boxtel, A., Matthys, W., & Meeus, W. (2012). Verbal, facial and autonomic responses to empathy-eliciting film clips by disruptive male adolescents with high versus low callous-unemotional traits. *Journal of Abnormal Child Psychology, 40*(2), 211–223. https://doi.org/10.1007/s10802-011-9557-8

Davidov, M., & Grusec, J. E. (2006). Untangling the links of parental responsiveness to distress and warmth to child outcomes. *Child Development, 77*(1), 44–58. https://doi.org/10.1111/j.1467-8624.2006.00855.x

Davidov, M., Zahn-Waxler, C., Roth-Hanania, R., & Knafo, A. (2013). Concern for others in the first year of life: Theory, evidence, and avenues for research. *Child Development Perspectives, 7*(2), 126–131. https://doi.org/10.1111/cdep.12028

Davis, M. H., Luce, C., & Kraus, S. J. (1994). The heritability of characteristics associated with dispositional empathy. *Journal of Personality, 62*(3), 369–391. https://doi.org/10.1111/j.1467-6494.1994.tb00302.x

Decety, J., & Svetlova, M. (2012). Putting together phylogenetic and ontogenetic perspectives on empathy. *Developmental Cognitive Neuroscience, 2*(1), 1–24. http://dx.doi.org.ezproxy1.lib.asu.edu/10.1016/j.dcn.2011.05.003

Denham, S. A. (1986). Social cognition, prosocial behavior, and emotion in preschoolers: Contextual validation. *Child Development, 57*(1), 194–201. https://doi.org/10.2307/1130651

Denham, S. A., & Grout, L. (1992). Mothers' emotional expressiveness and coping: Relations with preschoolers' social-emotional competence. *Genetic, Social, and General Psychology Monographs, 118*(1), 73–101.

Diamond, L. M., Fagundes, C. P., & Butterworth, M. R. (2012). Attachment style, vagal tone, and empathy during mother–adolescent interactions. *Journal of Research on Adolescence, 22*(1), 165–184. https://doi.org/10.1111/j.1532-7795.2011.00762.x

Drummond, J. D. K., Hammond, S. I., Satlof-Bedrick, E., Waugh, W. E., & Brownell, C. A. (2017). Helping the one you hurt: Toddlers' rudimentary guilt, shame, and prosocial behavior after harming another. *Child Development, 88*(4), 1382–1397. https://doi.org/10.1111/cdev.12653

Dunfield, K. A., & Kuhlmeier, V. A. (2010). Intention-mediated selective helping in infancy. *Psychological Science, 21*(4), 523–527. https://doi.org/10.1177/0956797610364119

Edwards, A., Eisenberg, N., Spinrad, T. L., Reiser, M., Eggum-Wilkens, N. D., & Liew, J. (2015). Predicting sympathy and prosocial behavior from young children's dispositional sadness. *Social Development, 24*(1), 76–94. https://doi.org/10.1111/sode.12084

Eggum, N. D., Eisenberg, N., Kao, K., Spinrad, T. L., Bolnick, R., Hofer, C., … Fabricius, W. V. (2011). Emotion understanding, theory of mind, and prosocial orientation: Relations over time in early childhood. *The Journal of Positive Psychology, 6*(1), 4–16. https://doi.org/10.1080/17439760.2010.536776

Eisenberg, N. (1986). *Altruistic emotion, cognition, and behavior*. Hillsdale, NJ: Erlbaum.

Eisenberg, N. (2010). Empathy-related responding: Links with self-regulation, moral judgment, and moral behavior. In M. Mikulincer & P. Shaver (Eds.), *Prosocial motives, emotions, and behavior: Herzlyia symposium on personality and social psychology* (pp. 129–148). Washington, DC: American Psychological Association Press.

Eisenberg, N., Cumberland, A., Guthrie, I. K., Murphy, B. C., & Shepard, S. A. (2005). Age changes in prosocial responding and moral reasoning in adolescence and early adulthood. *Journal of Research on Adolescence, 15*(3), 235–260. https://doi.org/10.1111/j.1532-7795.2005.00095.x

Eisenberg, N., Cumberland, A., & Spinrad, T. L. (1998). Parental socialization of emotion. *Psychological Inquiry, 9*(4), 241–273. https://doi.org/10.1207/s15327965pli0904_1

Eisenberg, N., Cumberland, A., Spinrad, T. L., Fabes, R. A., Shepard, S. A., Reiser, M., & Guthrie, I. K. (2001). The relations of regulation and emotionality to children's externalizing and internalizing problem behavior. *Child Development, 72*(4), 1112–1134. https://doi.org/10.1111/1467-8624.00337

Eisenberg, N., & Fabes, R. A. (1991). Prosocial behavior and empathy: A multimethod developmental perspective. In M. S. Clark (Ed.), *Prosocial behavior* (pp. 34–61, 327 Pages). Thousand Oaks, CA: Sage.

Eisenberg, N., & Fabes, R. A. (1998). Prosocial development. In N. Eisenberg (Ed.), *Handbook of child psychology: Social, emotional, and personality development* (Vol. 3, 5th ed., pp. 701–778). Hoboken, NJ: Wiley.

Eisenberg, N., Fabes, R. A., Karbon, M., Murphy, B. C., Carlo, G., & Wosinski, M. (1996). Relations of school children's comforting behavior to empathy-related reactions and shyness. *Social Development, 5*(3), 330–351. https://doi.org/10.1111/j.1467-9507.1996.tb00089.x

Eisenberg, N., Fabes, R. A., Murphy, B., Karbon, M., Maszk, P., Smith, M., … Suh, K. (1994). The relations of emotionality and regulation to dispositional and situational empathy-related responding. *Journal of Personality and Social Psychology, 66*(4), 776–797. https://doi.org/10.1037/0022-3514.66.4.776

Eisenberg, N., Fabes, R. A., Murphy, B., Karbon, M., Smith, M., & Maszk, P. (1996). The relations of children's dispositional empathy-related responding to their emotionality, regulation, and social functioning. *Developmental Psychology, 32*(2), 195–209. https://doi.org/10.1037/0012-1649.32.2.195

Eisenberg, N., Fabes, R. A., Schaller, M., Miller, P., Carlo, G., Poulin, R., … Shell, R. (1991). Personality and socialization correlates of vicarious emotional responding. *Journal of Personality and Social Psychology, 61*(3), 459–470. https://doi.org/10.1037/0022-3514.61.3.459

Eisenberg, N., Fabes, R. A., Shepard, S. A., Murphy, B. C., Jones, S., & Guthrie, I. K. (1998). Contemporaneous

and longitudinal prediction of children's sympathy from dispositional regulation and emotionality. *Developmental Psychology, 34*(5), 910–924. https://doi.org/10.1037/0012-1649.34.5.910

Eisenberg, N., Fabes, R. A., & Spinrad, T. L. (2006). Prosocial development. In N. Eisenberg, W. Damon, & R. M. Lerner (Eds.), *Handbook of child psychology: Social, emotional, and personality development* (Vol. 3, 6th ed., pp. 646–718). Hoboken, NJ: Wiley.

Eisenberg, N., Guthrie, I. K., Cumberland, A., Murphy, B. C., Shepard, S. A., Zhou, Q., & Carlo, G. (2002). Prosocial development in early adulthood: A longitudinal study. *Journal of Personality and Social Psychology, 82*(6), 993–1006. https://doi.org/10.1037/0022-3514.82.6.993

Eisenberg, N., Hofer, C., Sulik, M. J., & Liew, J. (2014). The development of prosocial moral reasoning and a prosocial orientation in young adulthood: Concurrent and longitudinal correlates. *Developmental Psychology, 50*(1), 58–70. https://doi.org/10.1037/a0032990

Eisenberg, N., Liew, J., & Pidada, S. U. (2001). The relations of parental emotional expressivity with quality of Indonesian children's social functioning. *Emotion, 1*(2), 116–136. https://doi.org/10.1037/1528-3542.1.2.116

Eisenberg, N., & McNally, S. (1993). Socialization and mothers' and adolescents' empathy-related characteristics. *Journal of Research on Adolescence, 3*(2), 171–191. https://doi.org/10.1207/s15327795jra0302_4

Eisenberg, N., Michalik, N., Spinrad, T. L., Hofer, C., Kupfer, A., Valiente, C., … Reiser, M. (2007). The relations of effortful control and impulsivity to children's sympathy: A longitudinal study. *Cognitive Development, 22*(4), 544–567. https://doi.org/10.1016/j.cogdev.2007.08.003

Eisenberg, N., & Spinrad, T. L. (2014). Multidimensionality of prosocial behavior: Rethinking the conceptualization and development of prosocial behavior. In L. M. Padilla-Walker & G. Carlo (Eds.), *Prosocial development: A multidimensional approach* (pp. 17–39). New York, NY: Oxford University Press.

Eisenberg, N., Spinrad, T. L., & Knafo-Noam, A. (2015). Prosocial development. In M. E. Lamb & R. M. Lerner (Eds.), *Handbook of child psychology and developmental science: Socioemotional Processes* (Vol. 3, 7th ed., pp. 610–656). Hoboken, NJ: Wiley.

Eisenberg, N., Spinrad, T. L., Taylor, Z. E., & Liew, J. (2017). Relations of inhibition and emotion-related parenting to young children's prosocial and vicariously induced distress behavior. *Child Development*. https://doi.org/10.1111/cdev.12934

Eisenberg, N., VanSchyndel, S. K., & Hofer, C. (2015). The association of maternal socialization in childhood and adolescence with adult offsprings' sympathy/caring. *Developmental Psychology, 51*(1), 7–16. https://doi.org/10.1037/a0038137

Eisenberg, N., VanSchyndel, S. K., & Spinrad, T. L. (2016). Prosocial motivation: Inferences from an opaque body of work. *Child Development, 87*(6), 1668–1678. https://doi.org/10.1111/cdev.12638

Eisenberg, N., Zhou, Q., & Koller, S. (2001). Brazilian adolescents' prosocial moral judgment and behavior: Relations to sympathy, perspective taking, gender-role orientation, and demographic characteristics. *Child Development, 72*(2), 518–534. https://doi.org/10.1111/1467-8624.00294

Ensor, R., & Hughes, C. (2005). More than talk: Relations between emotion understanding and positive behaviour in toddlers. *British Journal of Developmental Psychology, 23*(3), 343–363. https://doi.org/10.1348/026151005X26291

Ensor, R., Spencer, D., & Hughes, C. (2011). 'You feel sad?' Emotion understanding mediates effects of verbal ability and mother–child mutuality on prosocial behaviors: Findings from 2 years to 4 years. *Social Development, 20*(1), 93–110. https://doi.org/10.1111/j.1467-9507.2009.00572.x

Espelage, D., Green, H., & Polanin, J. (2012). Willingness to intervene in bullying episodes among middle school students: Individual and peer-group influences. *The Journal of Early Adolescence, 32*(6), 776–801. https://doi.org/10.1177/0272431611423017

Farrant, B. M., Devine, T. A. J., Maybery, M. T., & Fletcher, J. (2012). Empathy, perspective taking and prosocial behaviour: The importance of parenting practices. *Infant and Child Development, 21*(2), 175–188. https://doi.org/10.1002/icd.740

Feldman, R. (2007a). Mother-infant synchrony and the development of moral orientation in childhood and adolescence: Direct and indirect mechanisms of developmental continuity. *American Journal of Orthopsychiatry, 77*(4), 582–597. https://doi.org/10.1037/0002-9432.77.4.582

Feldman, R. (2007b). Parent-infant synchrony: Biological foundations and developmental outcomes. *Current Directions in Psychological Science, 16*(6), 340–345. https://doi.org/10.1111/j.1467-8721.2007.00532.x

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist, 56*(3), 218–226. https://doi.org/10.1037/0003-066X.56.3.218

Frick, P. J., & Morris, A. S. (2004). Temperament and developmental pathways to conduct problems. *Journal of Clinical Child and Adolescent Psychology, 33*(1), 54–68. https://doi.org/10.1207/S15374424JCCP3301_6

Frick, P. J., & White, S. F. (2008). Research review: The importance of callous-unemotional traits for developmental models of aggressive and antisocial behavior. *Journal of Child Psychology and Psychiatry, 49*(4), 359–375. https://doi.org/10.1111/j.1469-7610.2007.01862.x

Garner, P. W. (2003). Child and family correlates of toddlers' emotional and behavioral responses to a mishap.

Infant Mental Health Journal, 24(6), 580–596. https://doi.org/10.1002/imhj.10076

Garner, P. W. (2012). Children's emotional responsiveness and sociomoral understanding and associations with mothers' and fathers' socialization practices. *Infant Mental Health Journal, 33*(1), 95–106. https://doi.org/10.1002/imhj.20339

Garner, P. W., Dunsmore, J. C., & Southam-Gerrow, M. (2008). Mother-child conversations about emotions: Linkages to child aggression and prosocial behavior. *Social Development, 17*(2), 259–277. https://doi.org/10.1111/j.1467-9507.2007.00424.x

Garner, P. W., Jones, D. C., & Miner, J. L. (1994). Social competence among low-income preschoolers: Emotion socialization practices and social cognitive correlates. *Child Development, 65*(2), 622–637. https://doi.org/10.2307/1131405

Garner, P. W., Jones, D. C., & Palmer, D. J. (1994). Social cognitive correlates of preschool children's sibling caregiving behavior. *Developmental Psychology, 30*(6), 905–911. https://doi.org/10.1037/0012-1649.30.6.905

Geangu, E., Benga, O., Stahl, D., & Striano, T. (2011). Individual differences in infants' emotional resonance to a peer in distress: Self–other awareness and emotion regulation. *Social Development, 20*(3), 450–470. https://doi.org/10.1111/j.1467-9507.2010.00596.x

Gong, P., Fan, H., Liu, J., Yang, X., Zhang, K., & Zhou, X. (2017). Revisiting the impact of OXTR rs53576 on empathy: A population-based study and a meta-analysis. *Psychoneuroendocrinology, 80*, 131–136. https://doi.org/10.1016/j.psyneuen.2017.03.005

Guevara, I. P., Cabrera, V. E., Gonzalez, M. R., & Devis, J. V. (2015). Empathy and sympathy as mediators between parental inductive discipline and prosocial behavior in Colombian families. *International Journal of Psychological Research, 8*(2), 34–48.

Gummerum, M., Hanoch, Y., Keller, M., Parsons, K., & Hummel, A. (2010). Preschoolers' allocations in the dictator game: The role of moral emotions. *Journal of Economic Psychology, 31*(1), 25–34. https://doi.org/10.1016/j.joep.2009.09.002

Guthrie, I. K., Eisenberg, N., Fabes, R. A., Murphy, B. C., Holmgren, R., Mazsk, P., & Suh, K. (1997). The relations of regulation and emotionality to children's situational empathy-related responding. *Motivation and Emotion, 21*(1), 87–108. https://doi.org/10.1023/A:1024478415317

Hamlin, J. K., & Wynn, K. (2011). Young infants prefer prosocial to antisocial others. *Cognitive Development, 26*(1), 30–39. https://doi.org/10.1016/j.cogdev.2010.09.001

Hamlin, J. K., Wynn, K., Bloom, P., & Mahajan, N. (2011). How infants and toddlers react to antisocial others. *PNAS Proceedings of the National Academy of Sciences of the United States of America, 108*(50), 19931–19936. https://doi.org/10.1073/pnas.1110306108

Hastings, P. D., Zahn-Waxler, C., Robinson, J., Usher, B., & Bridges, D. (2000). The development of concern for others in children with behavior problems. *Developmental Psychology, 36*(5), 531–546. https://doi.org/10.1037/0012-1649.36.5.531

Hepach, R., Vaish, A., & Tomasello, M. (2012). Young children are intrinsically motivated to see others helped. *Psychological Science, 23*(9), 967–972. https://doi.org/10.1177/0956797612440571

Hoffman, M. L. (2000). *Empathy and moral development: Implications for caring and justice*. New York, NY: Cambridge University Press. https://doi.org/10.1017/CBO9780511805851

Hay, D. F., Castle, J., Davies, L., Demetriou, H., & Stimson, C. A. (1999). Prosocial action in very early childhood. Journal of Child Psychology and Psychiatry, 40(6), 905–916. https://doi.org/10.1111/1469-7610.00508

Hay, D. F. (1994). Prosocial development. Child Psychology & Psychiatry & Allied Disciplines, 35(1), 29–71. https://doi.org/10.1111/j.1469-7610.1994.tb01132.x

Kiang, L., Moreno, A. J., & Robinson, J. L. (2004). Maternal preconceptions about parenting predict child temperament, maternal sensitivity, and children's empathy. *Developmental Psychology, 40*(6), 1081–1092. https://doi.org/10.1037/0012-1649.40.6.1081

Killen, M., Mulvey, K. L., Richardson, C., Jampol, N., & Woodward, A. (2011). The accidental transgressor: Morally-relevant theory of mind. *Cognition, 119*(2), 197–215. https://doi.org/10.1016/j.cognition.2011.01.006

Kim, S., & Kochanska, G. (2017). Relational antecedents and social implications of the emotion of empathy: Evidence from three studies. *Emotion, 17*(6), 981–992. https://doi.org/10.1037/emo0000297

Knafo, A., Steinberg, T., & Goldner, I. (2011). Children's low affective perspective-taking ability is associated with low self-initiated pro-sociality. *Emotion, 11*(1), 194–198. https://doi.org/10.1037/a0021240

Knafo, A., & Uzefovsky, F. (2013). Variation in empathy: The interplay of genetic and environmental factors. In M. Legerstee, D. W. Haley, & M. H. Bornstein (Eds.), *The infant mind: Origins of the social brain* (pp. 97–120). New York, NY: Guilford Press.

Knafo, A., Zahn-Waxler, C., Davidov, M., Hulle, C. V., Robinson, J. L., & Rhee, S. H. (2009). Empathy in early childhood: Genetic, environmental, and affective contributions. In O. Vilarroya, S. Altran, A. Navarro, K. Ochsner, & A. Tobeña (Eds.), *Values, empathy, and fairness across social barriers* (pp. 103–114). New York, NY: New York Academy of Sciences.

Knafo, A., Zahn-Waxler, C., Van Hulle, C., Robinson, J. L., & Rhee, S. H. (2008). The developmental origins of a disposition toward empathy: Genetic and environmental contributions. *Emotion, 8*(6), 737–752. https://doi.org/10.1037/a0014179

Kochanska, G. (1991). Socialization and temperament in the development of guilt and conscience. *Child Development, 62*(6), 1379–1392. https://doi.org/10.2307/1130813

Kochanska, G. (1995). Children's temperament, mother's discipline, and security of attachment: Multiple path-

ways to emerging internalization. *Child Development, 66*(3), 597–615. https://doi.org/10.2307/1131937

Kochanska, G., Aksan, N., & Joy, M. E. (2007). Children's fearfulness as a moderator of parenting in early socialization: Two longitudinal studies. *Developmental Psychology, 43*(1), 222–237. https://doi.org/10.1037/0012-1649.43.1.222

Kochanska, G., Aksan, N., Knaack, A., & Rhines, H. M. (2004). Maternal parenting and children's conscience: Early security as moderator. *Child Development, 75*(4), 1229–1242. https://doi.org/10.1111/j.1467-8624.2004.00735.x

Kochanska, G., Barry, R. A., Jimenez, N. B., Hollatz, A. L., & Woodard, J. (2009). Guilt and effortful control: Two mechanisms that prevent disruptive developmental trajectories. *Journal of Personality and Social Psychology, 97*(2), 322–333. https://doi.org/10.1037/a0015471

Kochanska, G., Coy, K. C., & Murray, K. T. (2001). The development of self-regulation in the first four years of life. *Child Development, 72*(4), 1091–1111. https://doi.org/10.1111/1467-8624.00336

Kochanska, G., DeVet, K., Goldman, M., Murray, K., & Putnam, S. P. (1994). Maternal reports of conscience development and temperament in young children. *Child Development, 65*(3), 852–868. https://doi.org/10.2307/1131423

Kochanska, G., Forman, D. R., Aksan, N., & Dunbar, S. B. (2005). Pathways to conscience: Early mother-child mutually responsive orientation and children's moral emotion, conduct, and cognition. *Journal of Child Psychology and Psychiatry, 46*(1), 19–34. https://doi.org/10.1111/j.1469-7610.2004.00348.x

Kochanska, G., Gross, J. N., Lin, M., & Nichols, K. E. (2002). Guilt in young children: Development, determinants, and relations with a broader system of standards. *Child Development, 73*(2), 461–482. https://doi.org/10.1111/1467-8624.00418

Kochanska, G., Kim, S., Barry, R. A., & Philibert, R. A. (2011). Children's genotypes interact with maternal responsive care in predicting children's competence: Diathesis–stress or differential susceptibility? *Development and Psychopathology, 23*(2), 605–616. https://doi.org/10.1017/S0954579411000071

Kochanska, G., & Knaack, A. (2003). Effortful control as a personality characteristic of young children: Antecedents, correlates, and consequences. *Journal of Personality, 71*(6), 1087–1112. https://doi.org/10.1111/1467-6494.7106008

Kagan, J., & Fox, N. A. (2006). Biology, culture, and temperamental biases. In N. Eisenberg (Vol. Ed) and W. Damon & R. M. Lerner (Series Eds.), Handbook of Child Psychology: Social, Emotional, and Personality Development (Vol. 3, 6th ed, pp. 167–225) New York: Wiley.

Ladd, G. W., & Profilet, S. M. (1996). The child behavior scale: A teacher-report measure of young children's aggressive, withdrawn, and prosocial behaviors. *Developmental Psychology, 32*(6), 1008–1024. https://doi.org/10.1037/0012-1649.32.6.1008

Laible, D., Eye, J., & Carlo, G. (2008). Dimensions of conscience in mid-adolescence: Links with social behavior, parenting, and temperament. *Journal of Youth and Adolescence, 37*(7), 875–887. https://doi.org/10.1007/s10964-008-9277-8

Laible, D. J., & Carlo, G. (2004). The differential relations of maternal and paternal support and control to adolescent social competence, self-worth, and sympathy. *Journal of Adolescent Research, 19*(6), 759–782. https://doi.org/10.1177/0743558403260094

Lengua, L. J. (2003). Associations among emotionality, self-regulation, adjustment problems, and positive adjustment in middle childhood. *Journal of Applied Developmental Psychology, 24*(5), 595–618. https://doi.org/10.1016/j.appdev.2003.08.002

Lewis, M. (1992). *Shame: The exposed self*. New York, NY: Free Press.

Lewis, M. (2002). Empathy requires the development of the self. *Behavioral and Brain Sciences, 25*(1), 42. https://doi.org/10.1017/S0140525X02420055

Lewis, M. (2008). Self-conscious emotions: Embarrassment, pride, shame, and guilt. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 742–756). New York, NY: Guilford Press.

Liew, J., Eisenberg, N., Spinrad, T. L., Eggum, N. D., Haugen, R. G., Kupfer, A., … Baham, M. E. (2011). Physiological regulation and fearfulness as predictors of young children's empathy-related reactions. *Social Development, 20*(1), 111–134. https://doi.org/10.1111/j.1467-9507.2010.00575.x

Malti, T. (2016). Toward an integrated clinical-developmental model of guilt. *Developmental Review, 39*, 16–36. https://doi.org/10.1016/j.dr.2015.11.001

Malti, T., Eisenberg, N., Kim, H., & Buchmann, M. (2013). Developmental trajectories of sympathy, moral emotion attributions, and moral reasoning: The role of parental support. *Social Development, 22*(4), 773–793.

Malti, T., Gasser, L., & Gutzwiller-Helfenfinger, E. (2010). Children's interpretive understanding, moral judgments, and emotion attributions: Relations to social behaviour. *British Journal of Developmental Psychology, 28*(2), 275–292. https://doi.org/10.1348/026151009X403838

Malti, T., Gummerum, M., Keller, M., & Buchmann, M. (2009). Children's moral motivation, sympathy, and prosocial behavior. *Child Development, 80*(2), 442–460. https://doi.org/10.1111/j.1467-8624.2009.01271.x

Malti, T., & Krettenauer, T. (2013). The relation of moral emotion attributions to prosocial and antisocial behavior: A meta-analysis. *Child Development, 84*(2), 397–412. https://doi.org/10.1111/j.1467-8624.2012.01851.x

Malti, T., & Ongley, S. F. (2014). The development of moral emotions and moral reasoning. In M. Killen & J. G. Smetana (Eds.), *Handbook of moral development* (2nd ed., pp. 163–183). New York, NY: Psychology Press.

Malti, T., Ongley, S. F., Peplak, J., Chaparro, M. P., Buchmann, M., Zuffianò, A., & Cui, L. (2016). Children's sympathy, guilt, and moral reasoning in helping, cooperation, and sharing: A 6-year longitudinal study. *Child Development, 87*(6), 1783–1795. https://doi.org/10.1111/cdev.12632

McDonald, N. M., Baker, J. K., & Messinger, D. S. (2016). Oxytocin and parent–child interaction in the development of empathy among children at risk for autism. *Developmental Psychology, 52*(5), 735–745. https://doi.org/10.1037/dev0000104

Menesini, E., & Camodeca, M. (2008). Shame and guilt as behaviour regulators: Relationships with bullying, victimization and prosocial behaviour. *British Journal of Developmental Psychology, 26*(2), 183–196. https://doi.org/10.1348/026151007X205281

Miklikowska, M. (2018). Empathy trumps prejudice: The longitudinal relation between empathy and anti-immigrant attitudes in adolescence. *Developmental Psychology, 54*(4), 703–717. https://doi.org/10.1037/dev0000474

Miller, J. G., Kahle, S., & Hastings, P. D. (2017). Moderate baseline vagal tone predicts greater prosociality in children. *Developmental Psychology, 53*(2), 274–289. https://doi.org/10.1037/dev0000238

Miller, P. A., Eisenberg, N., Fabes, R. A., & Shell, R. (1996). Relations of moral reasoning and vicarious emotion to young children's prosocial behavior toward peers and adults. *Developmental Psychology, 32*(2), 210–219. https://doi.org/10.1037/0012-1649.32.2.210

Moreno, A. J., Klute, M. M., & Robinson, J. L. (2008). Relational and individual resources as predictors of empathy in early childhood. *Social Development, 17*(3), 613–637. https://doi.org/10.1111/j.1467-9507.2007.00441.x

Murphy, B. C., Shepard, S. A., Eisenberg, N., Fabes, R. A., & Guthrie, I. K. (1999). Contemporaneous and longitudinal relations of dispositional sympathy to emotionality, regulation, and social functioning. *The Journal of Early Adolescence, 19*(1), 66–97. https://doi.org/10.1177/0272431699019001004

Murphy, T. P., & Laible, D. J. (2013). The influence of attachment security on preschool children's empathic concern. *International Journal of Behavioral Development, 37*(5), 436–440. https://doi.org/10.1177/0165025413487502

Nichols, S. R., Svetlova, M., & Brownell, C. A. (2009). The role of social understanding and empathic disposition in young children's responsiveness to distress in parents and peers. *Cognition, Brain, Behavior: An Interdisciplinary Journal, 13*(4), 449–478.

Nickerson, A. B., Mele, D., & Princiotta, D. (2008). Attachment and empathy as predictors of roles as defenders or outsiders in bullying interactions. *Journal of School Psychology, 46*(6), 687–703. https://doi.org/10.1016/j.jsp.2008.06.002

Oberle, E., Schonert-Reichl, K., & Thomson, K. C. (2010). Understanding the link between social and emotional well-being and peer relations in early adolescence: Gender-specific predictors of peer acceptance. *Journal of Youth and Adolescence, 39*(11), 1330–1342. https://doi.org/10.1007/s10964-009-9486-9

Ongley, S. F., Nola, M., & Malti, T. (2014). Children's giving: Moral reasoning and moral emotions in the development of donation behaviors. *Frontiers in Psychology, 5*, 8.

Padilla-Walker, L. M., Carlo, G., Christensen, K. J., & Yorgason, J. B. (2012). Bidirectional relations between authoritative parenting and adolescents' prosocial behaviors. *Journal of Research on Adolescence, 22*(3), 400–408. https://doi.org/10.1111/j.1532-7795.2012.00807.x

Padilla-Walker, L. M., & Christensen, K. J. (2011). Empathy and self-regulation as mediators between parenting and adolescents' prosocial behavior toward strangers, friends, and family. *Journal of Research on Adolescence, 21*(3), 545–551. https://doi.org/10.1111/j.1532-7795.2010.00695.x

Panfile, T. M., & Laible, D. J. (2012). Attachment security and child's empathy: The mediating role of emotion regulation. *Merrill-Palmer Quarterly, 58*(1), 1–21. https://doi.org/10.1353/mpq.2012.0003

Pallini, S., Chirumbolo, A., Morelli, M., Baiocco, R., Laghi, F., & Eisenberg, N. (2018) The relation of attachment security status to effortful self-regulation: A meta-analysis.. Psychological Bulletin 144(5):501–531

Roberts, W., & Strayer, J. (1996). Empathy, emotional expressiveness, and prosocial behavior. *Child Development, 67*(2), 449–470. https://doi.org/10.2307/1131826

Roberts, W., Strayer, J., & Denham, S. (2014). Empathy, anger, guilt: Emotions and prosocial behaviour. *Canadian Journal of Behavioural Science/Revue Canadienne Des Sciences Du Comportement, 46*(4), 465–474. https://doi.org/10.1037/a0035057

Robinson, J. L., Zahn-Waxler, C., & Emde, R. N. (1994). Patterns of development in early empathic behavior: Environmental and child constitutional influences. *Social Development, 3*(2), 125–145. https://doi.org/10.1111/j.1467-9507.1994.tb00032.x

Rodrigues, S. M., Saslow, L. R., Garcia, N., John, O. P., & Keltner, D. (2009). Oxytocin receptor genetic variation relates to empathy and stress reactivity in humans. *PNAS Proceedings of the National Academy of Sciences of the United States of America, 106*(50), 21437–21441. https://doi.org/10.1073/pnas.0909579106

Rothbart, M. K., Ahadi, S. A., & Hershey, K. L. (1994). Temperament and social behavior in childhood. *Merrill-Palmer Quarterly, 40*(1), 21–39.

Roth-Hanania, R., Davidov, M., & Zahn-Waxler, C. (2011). Empathy development from 8 to 16 months: Early signs of concern for others. *Infant Behavior & Development, 34*(3), 447–458. https://doi.org/10.1016/j.infbeh.2011.04.007

Ruffman, T., Lorimer, B., & Scarf, D. (2017). Do infants really experience emotional contagion? *Child*

Development Perspectives. https://doi.org/10.1111/cdep.12244

Rothbart, M. K., & Bates, J. E. (2006). Temperament. In N. Eisenberg (Vol Ed.) and W. Damon & R. M. Lerner (Series Eds.), Handbook of Child Psychology: Social, Emotional, and Personality Development (Vol. 3, 6th ed, pp. 99–166). New York: Wiley.

Sallquist, J., Eisenberg, N., Spinrad, T. L., Eggum, N. D., & Gaertner, B. M. (2009). Assessment of preschoolers' positive empathy: Concurrent and longitudinal relations with positive emotion, social competence, and sympathy. *The Journal of Positive Psychology, 4*(3), 223–233. https://doi.org/10.1080/17439760902819444

Silfver, M., & Helkama, K. (2007). Empathy, guilt, and gender: A comparison of two measures of guilt. *Scandinavian Journal of Psychology, 48*(3), 239–246. https://doi.org/10.1111/j.1467-9450.2007.00578.x

Song, J., Colasante, T., & Malti, T. (2017). Helping yourself helps others: Linking children's emotion regulation to prosocial behavior through sympathy and trust. *Emotion*. https://doi.org/10.1037/emo0000332

Spinrad, T. L., Eisenberg, N., Gaertner, B., Popp, T., Smith, C. L., Kupfer, A., … Hofer, C. (2007). Relations of maternal socialization and toddlers' effortful control to children's adjustment and social competence. *Developmental Psychology, 43*(5), 1170–1186. https://doi.org/10.1037/0012-1649.43.5.1170

Spinrad, T. L., Losoya, S. H., Eisenberg, N., Fabes, R. A., Shepard, S. A., Cumberland, A., … Murphy, B. C. (1999). The relations of parental affect and encouragement to children's moral emotions and behaviour. *Journal of Moral Education, 28*(3), 323–337. https://doi.org/10.1080/030572499103115

Spinrad, T. L., & Stifter, C. A. (2006). Toddlers' empathy-related responding to distress: Predictions from negative emotionality and maternal behavior in infancy. *Infancy, 10*(2), 97–121. https://doi.org/10.1207/s15327078in1002_1

Stern, J. A., & Cassidy, J. (2017). Empathy from infancy to adolescence: An attachment perspective on the development of individual differences. *Developmental Review*. https://doi.org/10.1016/j.dr.2017.09.002

Stifter, C. A., Cipriano, E., Conway, A., & Kelleher, R. (2009). Temperament and the development of conscience: The moderating role of effortful control. *Social Development, 18*(2), 353–374. https://doi.org/10.1111/j.1467-9507.2008.00491.x

Strayer, J., & Roberts, W. (1989). Children's empathy and role taking: Child and parental factors, and relations to prosocial behavior. *Journal of Applied Developmental Psychology, 10*(2), 227–239. https://doi.org/10.1016/0193-3973(89)90006-3

Strayer, J., & Roberts, W. (2004). Empathy and observed anger and aggression in five-year-olds. *Social Development, 13*(1), 1–13. https://doi.org/10.1111/j.1467-9507.2004.00254.x

Tangney, J. P., Stuewig, J., & Mashek, D. J. (2007). Moral emotions and moral behavior. *Annual Review of Psychology, 58*, 345–372. https://doi.org/10.1146/annurev.psych.56.091103.070145

Taylor, S. J., Barker, L. A., Heavey, L., & McHale, S. (2013). The typical developmental trajectory of social and executive functions in late adolescence and early adulthood. *Developmental Psychology, 49*(7), 1253–1265. https://doi.org/10.1037/a0029871

Taylor, Z. E., Eisenberg, N., & Spinrad, T. L. (2015). Respiratory sinus arrhythmia, effortful control, and parenting as predictors of children's sympathy across early childhood. *Developmental Psychology, 51*(1), 17–25. https://doi.org/10.1037/a0038189

Taylor, Z. E., Eisenberg, N., Spinrad, T. L., Eggum, N. D., & Sulik, M. J. (2013). The relations of ego-resiliency and emotion socialization to the development of empathy and prosocial behavior across early childhood. *Emotion, 13*(5), 822–831. https://doi.org/10.1037/a0032894

Taylor, Z. E., Eisenberg, N., Spinrad, T. L., & Widaman, K. F. (2013). Longitudinal relations of intrusive parenting and effortful control to ego-resiliency during early childhood. *Child Development, 84*(4), 1145–1151. https://doi.org/10.1111/cdev.12054

Tong, L., Shinohara, R., Sugisawa, Y., Tanaka, E., Yato, Y., Yamakawa, N., … Japan Children's, S. G (2012). Early development of empathy in toddlers: Effects of daily parent–child interaction and home-rearing environment. *Journal of Applied Social Psychology, 42*(10), 2457–2478. https://doi.org/10.1111/j.1559-1816.2012.00949.x

Tone, E. B., & Tully, E. C. (2014). Empathy as a "risky strength": A multilevel examination of empathy and risk for internalizing disorders. *Development and Psychopathology, 26*(4), 1547–1565. https://doi.org/10.1017/S0954579414001199

Uzefovsky, F., Shalev, I., Israel, S., Edelman, S., Raz, Y., Mankuta, D., … Ebstein, R. P. (2015). Oxytocin receptor and vasopressin receptor 1a genes are respectively associated with emotional and cognitive empathy. *Hormones and Behavior, 67*, 60–65. https://doi.org/10.1016/j.yhbeh.2014.11.007

Uzefovsky, F., Shalev, I., Israel, S., Edelman, S., Raz, Y., Perach-Barzilay, N., … Ebstein, R. P. (2014). The dopamine D4 receptor gene shows a gender-sensitive association with cognitive empathy: Evidence from two independent samples. *Emotion, 14*(4), 712–721. https://doi.org/10.1037/a0036555

van der Mark, I. L., van IJzendoorn, M. H., & Bakermans-Kranenburg, M. (2002). Development of empathy in girls during the second year of life: Associations with parenting, attachment, and temperament. *Social Development, 11*(4), 451–468. https://doi.org/10.1111/1467-9507.00210

Vaish, A., Carpenter, M., & Tomasello, M. (2009). Sympathy through affective perspective taking and its relation to prosocial behavior in toddlers. *Developmental Psychology, 45*(2), 534–543. https://doi.org/10.1037/a0014322

Valiente, C., Eisenberg, N., Fabes, R. A., Shepard, S. A., Cumberland, A., & Losoya, S. H. (2004).

Prediction of children's empathy-related responding from their effortful control and parents' expressivity. *Developmental Psychology, 40*(6), 911–926. https://doi.org/10.1037/0012-1649.40.6.911

Valiente, C., Lemery-Chalfant, K., & Reiser, M. (2007). Pathways to problem behaviors: Chaotic homes, parent and child effortful control, and parenting. *Social Development, 16*(2), 249–267. https://doi.org/10.1111/j.1467-9507.2007.00383.x

Van Lissa, C. J., Hawk, S. T., Koot, H. M., Branje, S., & Meeus, W. H. J. (2017). The cost of empathy: Parent–adolescent conflict predicts emotion dysregulation for highly empathic youth. *Developmental Psychology, 53*(9), 1722–1737. https://doi.org/10.1037/dev0000361

Volbrecht, M. M., Lemery-Chalfant, K., Aksan, N., Zahn-Waxler, C., & Goldsmith, H. H. (2007). Examining the familial link between positive affect and empathy development in the second year. *The Journal of Genetic Psychology: Research and Theory on Human Development, 168*(2), 105–129. https://doi.org/10.3200/GNTP.168.2.105-130

Wade, M., Hoffmann, T. J., Wigg, K., & Jenkins, J. M. (2014). Association between the oxytocin receptor (OXTR) gene and children's social cognition at 18 months. *Genes, Brain & Behavior, 13*(7), 603–610. https://doi.org/10.1111/gbb.12148

Weller, D., & Lagattuta, K. H. (2013). Helping the in-group feels better: Children's judgments and emotion attributions in response to prosocial dilemmas. *Child Development, 84*(1), 253–268. https://doi.org/10.1111/j.1467-8624.2012.01837.x

Wellman, H., Cross, D., & Watson, J. (2001). Meta-analysis of theory-of-mind development: The truth about false belief. *Child Development, 72*(3), 655–684. https://doi.org/10.1111/1467-8624.00304

Wu, N., Li, Z., & Su, Y. (2012). The association between oxytocin receptor gene polymorphism (OXTR) and trait empathy. *Journal of Affective Disorders, 138*(3), 468–472. https://doi.org/10.1016/j.jad.2012.01.009

Yagmurlu, B. (2014). Relations among sociocognitive abilities and prosocial behavior. *Journal of Child and Family Studies, 23*(3), 591–603. https://doi.org/10.1007/s10826-013-9726-1

Young, S. K., Fox, N. A., & Zahn-Waxler, C. (1999). The relations between temperament and empathy in 2-year-olds. *Developmental Psychology, 35*(5), 1189–1197. https://doi.org/10.1037/0012-1649.35.5.1189

Zahn-Waxler, C., Radke-Yarrow, M., Wagner, E., & Chapman, M. (1992). Development of concern for others. *Developmental Psychology, 28*(1), 126–136. https://doi.org/10.1037/0012-1649.28.1.126

Zahn-Waxler, C., Robinson, J. L., & Emde, R. N. (1992). The development of empathy in twins. *Developmental Psychology, 28*, 1038–1047. https://doi.org/10.1037/0012-1649.28.6.1038

Zahn-Waxler, C., Schiro, K., Robinson, J. L., Emde, R. N., & Schmitz, S. (2001). Empathy and prosocial patterns in young MZ and DZ twins: Development and genetic and environmental influences. In R. N. Emde & J. K. Hewitt (Eds.), *Infancy to early childhood: Genetic and environmental influences on developmental change* (pp. 141–162). New York, NY: Oxford University Press.

Zhou, Q., Eisenberg, N., Losoya, S. H., Fabes, R. A., Reiser, M., Guthrie, I. K., … Shepard, S. A. (2002). The relations of parental warmth and positive expressiveness to children's empathy-related responding and social functioning: A longitudinal study. *Child Development, 73*(3), 893–915. https://doi.org/10.1111/1467-8624.00446

Part III

Cognition and Context in Emotional Development

Cognition and Emotion in Development

Martha Ann Bell, Christy D. Wolfe, Anjolii Diaz, and Ran Liu

Abstract

Emotion development is best understood within the context of cognitive processes, supporting a model of cognition–emotion integration focused on the development of self-regulation. Literature on the means by which cognition affects emotion processes tends to emphasize attentional control and executive function frameworks. Research on emotion affecting cognitive processes tends to focus on negative and positive emotions, typically from a temperament framework or emotion frameworks. Cognition and emotion as interactive processes are highlighted as we describe our self-regulation model, which also includes prenatal, parenting, and larger environmental components. We end with critical questions for future research.

Great historical traditions, rich in well-respected theories and strong research paradigms and methodologies, exist for nearly all components of development: cognitive development, social development, emotional development, moral development, etc. This division of the child into different and separable components was not done without admirable reason. For example, since the emergence of behaviorism in the late 1800s within the evolution of psychology, scientists have been challenged to isolate their particular variable of interest in an attempt to observe and measure it objectively and convincingly. In addition, the scientific process, having roots in Cartesian dualism, assumes that certain aspects of the person (e.g., mind and body) can be identified, isolated, and manipulated presumably without having any rippling or far-reaching effects in another aspect or system of the person. Like others, we believe that this tradition of compartmentalizing and piecemealing the child and the

Bell and Wolfe share the first authorship of this chapter.

The writing of this chapter was supported by grants HD049878 and HD091644 from the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD). The content of this manuscript is solely the responsibility of the authors and does not necessarily represent the official views of the NICHD or the National Institutes of Health.

M. A. Bell (✉) · R. Liu
Virginia Tech, Department of Psychology, Blacksburg, VA, USA
e-mail: mabell@vt.edu

C. D. Wolfe
Bellarmine University, Department of Psychology, Louisville, KY, USA

A. Diaz
Ball State University, Department of Psychological Science, Muncie, IN, USA

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_15

child's experiences is artificial and limiting to our scientific advancement and progress toward a thorough, complete, and accurate account of a systemic process as complex as human development (Calkins, 2015; Oakes, 2009). We should be focused on a multilevel approach to development that incorporates complex psychobiological processes situated in a rich, complex social environment (Bell, 2015).

The premise of our chapter is that any conceptualization of emotion development is incomplete without accompanying consideration of cognition. Well-regulated emotion and cognition processes are critical to optimal development in childhood and beyond (Bell & Calkins, 2012; Bell & Deater-Deckard, 2007; Blair, Calkins, & Kopp, 2010; Rothbart, Sheese, Rueda, & Posner, 2011). Although we know that beginning in infancy and progressing into middle childhood nearly all children show dramatic improvements in their emotion-related development, the early foundations of the developmental progression in top-down mental processes are poorly understood. The current theory postulates that optimal development of the self-control aspect of emotion is promoted by certain complements of genes associated with frontal lobe architecture and development, and yet, the frontal systems contributing to these processes in early development remain elusive and relatively unexamined.

In this chapter, we discuss how we conceptualize cognition and emotion processes across development. Our overarching theme is that cognition and emotion are best considered within a model focused on self-regulation (Bell & Calkins, 2012; Bell & Deater-Deckard, 2007; Bell & Wolfe, 2004). We begin with a tale of two children and use their experiences in our lab to briefly introduce our overarching self-regulation framework for conceptualizing the integration of cognition and emotion processes. We then summarize literature on how cognition and emotion processes are interrelated, describe our self-regulation model in detail, and conclude with critical areas for future research on self-regulation.

A Tale of Two Children

Four-year-old Riley visits our research lab. Peering from behind mother, Riley is cautious and quiet, yet attentive and curious. After a few tentative warm-up games and gentle maternal coaxing, Riley agrees to wear our "space cap" and "sticky patches." Seated motionless in our space chair, Riley is unsure about the situation but listens as the research assistant explains the instructions of the day–night task (Gerstadt, Hong, & Diamond, 1994). After a somber glance at the mother for reassurance, we begin. Riley's voice is barely audible, and performance in the first three trials of our task is spotty but improves steadily and ends with impressive accuracy. When the task is finished, Riley remains seated quietly in the chair and offers an acquiescent smile when praised for performance.

The same day, 4-year-old Taylor visits our lab. Taylor is talkative and energetic, engages with lab members, and inspects what we have hidden in storage behind a floor-length tablecloth. Taylor readily accepts the "space cap" and "sticky patches" and challenges the research assistant to wear a cap also. This 4-year-old is active and in constant motion, restricted only by the length of our electrode wires. Our fleeting concern about having any useable physiology data is replaced quickly by the threat of our space chair tipping over at any moment—with Taylor in it! The research assistant rests a foot on the base of the chair to steady it, captures Taylor's attention, and gives instructions for the day–night task. Taylor quickly smiles in recognition of the "trick" of the task and responds confidently, clearly, and correctly on the first three trials. On the fourth and fifth trials, we hear incorrect responses but with immediate "oops" and self-corrections. The remaining trials are completed perfectly. When this task is finished, Taylor elects to remove the space cap and sticky patches, jumps from the top step of the chair with a rocket-launch sound effect, and politely asks for another snack.

The differences between these two lab visits are striking, yet important similarities exist. It is

clear that Riley and Taylor have two *very different* emotional reactivity and regulation profiles, but it also is true that they had two *very similar* experiences in our lab this day. Both children—one shy and one exuberant—successfully regulated their dominant behavioral and emotional tendencies when the situation required them to do so. Riley overcame fearful reactivity and pushed to interact with an unfamiliar adult in a new environment, perform novel tasks, adorn a strange cap and stickers, and keep attention focused on the task, as opposed to any worrisome or self-conscious thoughts. Likewise, Taylor regulated a surgent behavioral style and harnessed a strong desire to run, jump, and explore in service of being seated, focusing attention, and engaging with the researcher when it was most critical to do so.

In addition to their impressive behavioral regulation of their different emotion reactivity styles, both children demonstrated strong performance in our tasks of executive function. These tasks require the skills of working memory, inhibitory control, and attentional control (Wolfe & Bell, 2004). The successful integration of these skills is a developmental milestone acquired during the early childhood years with significant individual variation in the age of achievement (Montroy, Bowles, Skibbe, McClelland, & Morrison, 2016). Thus, Riley and Taylor demonstrated the ability to regulate their emotion and behavior, focus their attention, engage with the research assistant, and successfully follow the directions of a challenging cognitive task; they demonstrated *self-regulation* (Bell & Deater-Deckard, 2007; Blair, 2002; Blair & Raver, 2015; Kopp, 2002; Posner & Rothbart, 2000). We propose that self-regulation is the most efficient model for examining the development of cognitive and emotion processes.

The development of self-regulation appears to demonstrate heterogeneity in developmental trajectories across early childhood and into middle childhood (e.g., Montroy et al., 2016). As developmentalists, we are curious about how children come to be the way that they are and about the different pathways that might have led Riley and Taylor to have very similar successes in our lab this day. Investigations into the development of their self-regulatory abilities must begin with a consideration of those variables we observed in the lab that day, specifically their cognitive skills, their emotion reactivity and regulation, and the functioning of their physiological systems that subserve both processes. Finally, as it is certain that the integration and functioning of these regulatory systems represent a developmental process that has evolved through a complex network of historical events and experiences, the progression of these regulatory systems in the context of their environment must be considered (Calkins, 2011; Deater-Deckard, 2014; Sameroff, 2010).

Our research on typically developing children is based on the psychobiological premise that infant and child behavior is complex and requires a multilevel approach to understand its developmental course (Bell, 2015). Such intricacy requires a comprehensive view of development that not only incorporates multiple levels of analysis but also ignores traditional boundaries between disciplines. This is especially true for the study of early cognition and emotion, where many researchers embrace a maturational view of development. The classic developmental cognitive neuroscience conceptualization of cognition is that maturation of a specific brain area, as determined by genetic blueprint, defines the developmental time course of cognitive behavior linked to that brain area. The developmental affective neuroscience point of view marks similar brain maturation mapping for emotion development (e.g., Casey, Jones, & Somerville, 2011).

We propose that the most comprehensive consideration of both cognitive and emotion development is from a psychobiological perspective, focusing on research that incorporates complex biological processes situated in a rich, complex environment (Lickliter, 2013; Lickliter & Honeycutt, 2013). We further propose that cognition and emotion development are best considered with a conceptualization that integrates the two processes to describe complex, multilevel development of self-regulatory processes (Bell, 2015; Bell & Wolfe, 2004). In this chapter, we review cognition–emotion research on infants and children. We use a framework initially provided by Cole, Martin, and Dennis (2004) and then empha-

sized by Carlson and Wang (2007) by focusing first on unidirectional impact of cognition on emotion outcomes and second on the unidirectional impact of emotion on cognition outcomes. In both instances, we note research on negative emotions and positive emotions. We then propose a model of early development of self-regulation that we consider the most appropriate model for studying cognition–emotion relations in which emotion and cognition processes continuously influence each other across a developmental time course and in a dynamic manner of self-regulation. We end by listing critical questions of early cognition–emotion development.

Cognition Influences Emotion Outcomes

Emotion development research can be enriched by examining how thinking, learning, and action help to regulate children's emotions (Cole et al., 2004). There are two traditional frameworks in the study of cognitive influences on emotion regulation. Based on a cognitive/neural system framework, the cognitive processes that appear to facilitate control of emotional reactivity include attention and executive functions (EFs) (Gross, 1998). From a temperament-based view, effortful control (EC) describes the important role that executive attention plays in emotion regulation (Rothbart & Bates, 2006). We regard the two frameworks as complementary in describing self-regulation mechanisms (Zhou, Chen, & Main, 2012) and discuss both here to provide a more comprehensive review of how cognition influences emotion.

Attention

Regulation of attention plays a fundamental role in the emergence and development of emotion regulation (Kopp, 2002). The ability to voluntarily focus and shift attention is an essential skill for regulating both positive and negative emotions (Fox & Calkins, 2003). Three separate brain networks are involved in different but interrelated attention-related tasks: the alerting, orienting, and executive networks (Posner & Raichle, 1994). Alerting refers to achieving and maintaining the alert state and involves the midbrain, parietal lobe, and frontal cortex. Orienting indicates the ability to attend to a given location. Major brain areas of this network include the superior parietal lobe, temporal parietal junction, and frontal eye fields. Executive attention network is activated when there is conflict between different possible responses to an event. Among the three networks, executive attention is the network that supports the voluntary control of attention and involves the anterior cingulate cortex (ACC) and the lateral prefrontal cortex (Posner & Rothbart, 2007). ACC is an important cortical outflow of the limbic system, which allows for the integration of attention and emotion (Vogt, Finch, & Olson, 1992). The executive attention network therefore seems to be an important neural mechanism involved in the regulation of emotional experience and expression. Executive attention has also been recognized as a neural underpinning of temperamental effortful control (EC), which is defined as the ability to suppress a dominant response and to perform a subdominant one (Posner & Rothbart, 1998).

Attention research from a temperament framework Rothbart's temperament-based model of attention as a cognitive process affecting emotion outcomes has been very influential in the developmental literature (Rothbart, 2011; Rothbart & Bates, 2006). The orienting network matures early in development and seems to play a fundamental role in regulating infant distress until the development of the more volitionally controlled executive attention system (Posner & Rothbart, 2007). Before 3 months of age, caregivers mainly use holding and rocking to soothe their children. At around 3 months, many caregivers begin to distract infants to other stimuli in order to quiet them. When infants orient to the distracting stimuli, their distress is significantly reduced. Before 4 months, however, infants show little control of orienting on their own and mainly rely on caregivers to distract them (Ruff & Rothbart, 1996). By 4 months old, infants show considerable improvement in controlling

their gaze to disengage from one location to another. The ability to disengage gaze from a stimulus may serve as an important emotion regulatory function in young infants (Posner & Rothbart, 2007). For instance, greater flexibility of orienting in the laboratory at 4 months is associated with lower parent-reported negative emotionality and greater soothability in measures of infant temperament (Johnson, Posner, & Rothbart, 1991). In addition, disengagement of attention is negatively related to distress and positively related to smiling and laughter in the laboratory at 13 months old (Rothbart, Ziaie, & O'Boyle, 1992). Similarly, orienting behaviors, as effective attention strategies, reduce the level of frustration and distress caused, respectively, by arm restraint at 5 months and by toy removal at 10 months (Stifter & Braungart, 1995). Furthermore, orienting can modulate emotion when infants are presented with interesting visual and auditory distractors. As infants orient to the distractors, they no longer show facial and vocal signs of distress. As soon as the distractors are removed, the infants' distress returns back to almost the same level shown before the presentation of the distractor (Harman, Rothbart, & Posner, 1997).

There is a transition in dominant control from the orienting network in infancy to the executive network during preschool ages (Rothbart et al., 2011). During childhood and adulthood, the executive network and associated EC make important contributions to the control of emotions. Although the orienting work may still have an effect on emotion outcomes, the executive network is the primary mechanism that interacts with the limbic system in regulating negative and positive emotions (Rothbart & Sheese, 2007). In a longitudinal study that aimed to examine the chief control attentional method during different developmental periods, Rothbart and colleagues (2011) noted that during infancy (i.e., 6–7 months), the orienting network contributed to both reducing negative affect and increasing surgency/positive affect. During preschool period (i.e., 3–4 years), executive attention, rather than orienting, was associated with the modulating of surgency/positive affect, suggesting that across development, the orienting networks loses dominance to the executive network in regulating both negative and positive emotions.

With respect to the regulation of negative emotion, executive attention and EC have been shown to be effective mechanisms. Most of these types of research studies have focused on young children. For example, young boys with good attentional control are better able to deal with anger by using more constructive coping strategies (Eisenberg, Fabes, Nyman, Bernzweig, & Pinuelas, 1994). In a study that examined self-regulation in a spatial conflict task, there was evidence that 36-month-old children who make more perseveration errors are more prone to anger/frustration (Gerardi-Caulton, 2000). Kochanska, Murray, and Harlan (2000) reported that children high in EC are better able to regulate anger at 22 months and regulate both anger and joy at 33 months. In a study of older children between the ages of 9 and 14 years, the lack of capacity in attention focusing and attention shifting predicted anxiety symptoms (Susa, Pitică, Benga, & Miclea, 2012). A recent study reported a similar finding in young children, in that EC was negatively related to social withdrawal in 5-year-old children (Cole, Zapp, Fettig, & Pérez-Edgar, 2016).

Research teams that study the effect of executive attention and EC in modulating the expression of positive emotions often apply the mistaken gift paradigm (Kieras, Tobin, Graziano, & Rothbart, 2005; Simonds, Kieras, Rueda, & Rothbart, 2007). During the task, the child is presented with several toys and asked to rank them from most to least desirable. Following the administration of other tasks, the child receives the gift he/she ranked last. After a specific delay, the experimenter gives the child the gift he/she ranked as most desirable. Children's smiling or positive affect is coded after they received the desirable and undesirable gifts. In a study with 7- to 10-year-old children, evidence showed that executive attention, measured by the attention network task, significantly predicts duration of smiling to the undesirable gift (Simonds et al., 2007). With preschool children, researchers have

noted that children with high EC show similar levels of positive affect after receiving the desirable and undesirable gifts. Children with low EC, however, show less positive affect after receiving the undesirable gift relative to the desirable gift (Kieras et al., 2005).

Attention research from a cognitive processes framework Gross' (1998) process model of emotion regulation may help explain how interrelated regulatory processes differentially influence emotions. The key idea underlying the model is that different attentional and cognitive strategies can be applied at different time points in the regulation of emotion. Antecedent-focused strategies occur before emotional responses become fully activated, whereas response-focused strategies refer to approaches that are activated after the emotion response has been generated. As an important antecedent-focused strategy, attentional control or attentional deployment helps regulate negative emotions by disengaging attention from emotional processing (Gross & Thompson, 2007). For example, Lonigan, Vasey, Phillips, and Hazen (2004) suggest that as soon as stimuli are consciously perceived, individuals can employ effortful mechanisms to shift their attention away from anxiety-producing stimuli.

Some research has examined how attention serves to regulate emotion by using scalp-recorded event-related potentials (ERPs) to detect neural markers that capture cognition–emotion interactions. The existing research indicates two important types of potential ERP markers: those that reflect attentional control under emotional demands and those that reflect attentional processing of negative emotional stimuli (Dennis, 2010). Assessing children's cognitive and attentional skills under emotional processing demands may reflect essential regulatory abilities that support the development of adaptive emotion regulation. The ERP waveforms of interest in this research are typically the N2 and ERN, which reflect conflict monitoring and error detection that require executive attention (Donkers & Van Boxtel, 2004; Van Veen & Carter, 2002). ERP waveforms detected over the frontal cortex can capture the attentional control that is used to regulate emotions. For instance, Lewis, Lamm, Segalowitz, Stieben, and Zelazo (2006) assessed children's ERP responses in a negative emotion induction process. Results indicated that N2 showed larger amplitude in the go/no go trials after losing points compared with gaining points for children 13–16 years of age, suggesting that more executive attention was recruited in regulating negative emotions.

Research that has examined attention processing to emotion reveals that the late positive potential (LPP) reflects facilitated attention to emotion images in adults. LPP shows enhanced amplitude in response to emotional versus neutral stimuli (Hajcak & Olvet, 2008). Research with adults shows that the amplitude of the LPP was reduced after applying cognitive emotion regulation strategies, such as reappraisal (Parvaz, MacNamara, Goldstein, & Hajcak, 2012). There is limited research, however, on how the LPP operates following cognitive reappraisal in children. Dennis and Hajcak (2009) found that for children who were 5–10 years of age, the LPP is reduced after reinterpreting an unpleasant picture in more neutral terms (i.e., cognitive reappraisal). DeCicco, Solomon, and Dennis (2012), however, reported that LPP was not sensitive to reappraisal in 5- to 7-year-old-children, although this same group of children showed the expected reductions in the LPP following reappraisal by 8–9 years of age (DeCicco, O'Toole, & Dennis, 2014). Babkirk, Rios, and Dennis (2015) suggested that if this reappraisal-induced reduction of the LPP reflects regulatory capacity, then it should predict the ability to use adaptive emotion regulation strategies. Consistent with their hypothesis, children (5–7 years of age) who showed reappraisal-induced reductions in the LPP could use more adaptive ER strategies concurrently and 2 years later compared with children whose LPPs were not sensitive to reappraisal. Overall, these studies suggest that for children, especially after 7 years of age, cognitive reappraisal could reduce their attention to emotional stimuli, indicated by reduced LPP, and therefore facilitate emotion regulation.

Executive Functions

Executive functions (EFs) refer to a series of top-down goal-directed basic cognitive abilities, including inhibitory control (IC), working memory (WM), and cognitive flexibility (also called shifting). More complex EFs include problem-solving, planning, and reasoning (Diamond, 2013). EFs are first evident by 8–9 months of age and improve significantly across the preschool period (Bell, 2002; Diamond, 2006). The development of EFs primarily depends on the maturation of the prefrontal cortex (Diamond & Lee, 2011). IC indicates the ability to control the dominant predisposition to instead perform the subdominant or more needed response (Diamond, 2013). IC develops rapidly between 3 and 5 years, with 3-year-old children having difficulty on tasks that require IC but by age 5 children are able to resolve conflicts between behavioral responses, waiting for a delay, and controlling prevailing behaviors based on rules (Carlson, 2005). WM involves holding information in mind and mentally working with it. The ability to hold and update information in mind develops early in life and has a prolonged developmental progression (Cuevas & Bell, 2010; Diamond, 2013). Cognitive flexibility or shifting refers to the ability to shift from one "mental set" to another and is believed to build upon the development of IC and WM (Garon, Bryson, & Smith, 2008).

The development of EFs contributes to children's emotion regulation abilities (Fox & Calkins, 2003). WM plus IC may decrease undesirable emotional experiences, inappropriate emotional expressions, and probably even the physiological markers of emotional arousal (Gross, 1998). For instance, Wolfe and Bell (2004) reported that for 4-year-old-children, WM and IC are negatively associated with anger and frustration. Hudson and Jacques (2014) examined multiple individual characteristics that might contribute to emotion regulation at ages 5–7 years in a disappointing gift task, as well as the amount of effort required to control emotion display after receiving the disappointing gift. They reported that IC predicts children's emotion regulation and the observed effort dedicated to controlling emotion. The effect of EFs on emotion regulation may also depend on other factors. For instance, Choi and Song (2014) found that for children from 3 to 5 years of age, WM predicts emotion regulation. The relationship, however, is moderated by sex. Specifically, the influence of WM on emotion regulation was significant only in boys, but not in girls.

When applying Gross's (1998) process model to our understanding of how EFs affect emotion, it becomes evident that EFs facilitate emotion regulation at different time points in the process model, including both prior to the emotion experience and afterwards. Individuals with high WM capacity may have superior ability and greater flexibility in appraising emotion stimuli in an unemotional manner (Hofmann, Friese, Schmeichel, & Baddeley, 2011). For instance, young adults who are higher in WM capacity are at an advantage in cognitive reappraisal and thus experience less intense emotion in response to stimuli (Schmeichel, Volokhov, & Demaree, 2008). Neurophysiological research indicates that when reappraising negative emotions, adults show increasing activity in dorsal ACC and PFC, suggesting that prefrontally mediated EFs are being recruited to regulate the experience of emotions in an antecedent manner (Gross, 1998; Ochsner & Gross, 2005). fMRI research with 8- to 10-year-old children shows similar patterns of brain activation. Reappraisal of a sad film activates bilateral medial PFC, lateral PFC, right ACC, and right ventral lateral PFC (Lévesque et al., 2004). These areas are reported to be associated with EFs during childhood (Tsujimoto, 2008; Tsujimoto, Yamamoto, Kawaguchi, Koizumi, & Sawaguchi, 2004), suggesting that as with adults, EFs may antecedently affect children's experience of emotions via cognitive reappraisal (Gross, 1998).

EFs can also control the expressions of emotion after it has been fully activated (Hofmann et al., 2011). Young adults with higher WM capacity are better able to suppress expressions of negative emotion and positive emotions (Schmeichel et al., 2008). Similarly, young adults with lower IC are more likely to express negative emotions, suggesting that IC may contribute to

the regulation of emotion expression (Bridgett, Oddi, Laake, Murdock, & Bachmann, 2013). Findings are similar in children. In a study that examined the associations between EFs and emotion regulation, results showed that 4- to 6-year-old children with high IC exhibit less negative emotions upon receiving the undesired gift compared with children with low IC (Carlson & Wang, 2007).

In addition to directly affecting emotion regulation, EFs have been shown as significant predictors of emotion understanding or emotion comprehension, which may facilitate emotion regulation (Hudson & Jacques, 2014). Cognitive flexibility or shifting has a considerable impact on the development of emotion understanding, over and above mothers' age, children's IQ, language ability, and theory of mind for young children (Martins, Osório, Veríssimo, & Martins, 2016). Similarly, the development of WM predicts the development of emotion comprehension at ages 5–11 years (Morra, Parrella, & Camba, 2011). Moreover, young children who perform better on the Simon Says task, which indicates higher IC, show greater emotion understanding ability (Carlson & Wang, 2007).

Together empirical research suggests that EFs facilitate children's ability to understand and regulate emotions in multiple ways. In particular, children with high EFs are better able to cognitively reappraise emotional stimuli in unemotional ways, as well as suppress the expression of emotions. With the development of PFC, the role of EFs in emotion regulation becomes more salient and contributes to adaptive socioemotional outcomes.

Emotion Influences Cognitive Outcomes

Emotions act to organize thinking, learning, and action (Cole et al., 2004) because emotions have an impact on cognitive outcomes. To examine these processes, researchers may manipulate emotion in the experimental situation and inspect the effect on cognitive performance (Gray, 2004; Richards & Gross, 2000). Most of the time, however, researchers examine normal variations in emotion reactivity and emotion regulation (i.e., temperament) to study the impact of emotion on cognitive outcomes. We report on effects of both positive (joy, happiness, exuberance, etc.) and negative (distress, anger, fear/anxiety, etc.) emotion on cognition; we focus on positive and negative emotion in general, rather than on specific emotions, for organizational purposes. Throughout, we note multiple underlying theoretical frameworks that have been used to explain the impact of emotion on cognitive processes.

Over half a century ago, Izard and colleagues (1965, 1964) posited that emotions influence cognitive functioning. Such sentiments underlie "functionalist" perspectives of emotion, where emotions are described as internal monitoring and guidance systems that function to regulate both intra- and interpersonal behaviors, appraise events, motivate behaviors, and shape responses (Campos, Barrett, Lamb, Goldsmith, & Stenberg, 1983). The "engine model of well-being" has also emphasized the role of emotions by proposing a need to distinguish and treat affect and emotions as process variables or internal states that influence choice and behavior rather than behavioral outcomes (Jayawickreme, Forgeard, & Seligman, 2012). This framework for understanding goal-directed functioning recognizes emotions as critical for the engagement of activities and behaviors that lead to success as well as the development of intrinsically valuable cognitive behaviors in the school context (Weber, Wagner, & Ruch, 2016). Such theories reinforce standing assumptions that emotions are crucial in the learning process and for optimal functioning (Eisenberg, Fabes, Guthrie, & Reiser, 2000; Fredrickson, 2001; Valiente, Swanson, & Eisenberg, 2012).

Today, the critical role of emotion on cognitive processes is supported by neurological studies. Research on the ACC highlights the neural connections between its two major subdivisions that process cognitive and emotional information becoming denser over time and demonstrating some integration across domains (Banfield, Wyland, Macrae, Munte, & Heatherton, 2004; Bush, Luu, & Posner, 2000).

The role of emotion in cognitive functioning also gains support from brain maturation studies mapping the trajectory and sequencing of neurological development. Specifically, the human brain develops in a back-to-front pattern, which results in some cortical and subcortical areas of the brain following different developmental timetables. For instance, more posterior areas like the limbic system which includes the amygdala, a structure associated with emotions, emotional reactions, and emotion processing, develops and matures quite early on in development (Gallagher & Chiba, 1996; Gogtay et al., 2004; Phelps & LeDoux, 2005). However, the prefrontal cortex—an anterior area of the brain that is responsible for managing and regulating various behaviors including higher-order cognitive abilities like reasoning and thinking—develops later and continues to mature well into adulthood (Arain et al., 2013; Luna, Garver, Urban, Lazar, & Sweeney, 2004). Therefore, top-down cortical executive functioning processes associated with the prefrontal cortex which include WM, IC, and shifting are less developed than subcortical structures involved in the generation of emotion (Calkins & Marcovitch, 2010). This temporal gap between the development of the socioemotional system of the brain and the cognitive control system of the brain partially explains certain characteristics of adolescence, specifically decision-making and problem-solving being primarily influenced by emotions and emotional states (Casey et al., 2011; Dahl, 2001; Steinberg, 2005). Given the timing of both systems, emotions may exert a powerful influence over the development of subsequent cognitive abilities and outcomes before top-down cognitive processes can be efficiently recruited to assist in their expression and regulation (Blair, 2002; Ursache, Blair, & Raver, 2012). Although Izard proposed the critical nature of emotion in cognitive development in the mid-1960s, it is only more recently that researchers have begun to ask whether individual differences in emotions relate to individual differences in the cognitive performance or cognitive development of young children.

Negative Emotions

Most of the limited research on the effects of emotion on cognitive outcomes has focused on negative emotions. Negative emotion narrows and minimizes attention, cognition, and behavior in order to focus on the problem at hand (Fredrickson & Branigan, 2005). Although such actions tend to be adaptive in the short term, especially in threatening circumstances, negative emotions are thought to interfere with performance and reduce learning opportunities in the long run (Fredrickson, 2001; Lewis, Huebner, Reschly, & Valois, 2009). Moreover, researchers have argued that individual differences in early characteristics (including negative affect) may be related to the frequency and the degree to which one engages and interacts with novel aspects of the environment, which is essential for early cognitive development and cognitive competence (Lerner & Lerner, 1983; Rothbart & Derryberry, 1981).

Negative emotions from a temperament perspective Infants use facial and vocal reactions as strategic means to make caregivers aware of their needs but, more importantly, bring caregivers closer, increasing their opportunities for cognitive interactions (Bornstein & Putnick, 2012). Indeed, links between cognition and emotion are evident as early as infancy, with some research supporting the assumption that the negative emotion is associated with less efficient task-focusing strategies and therefore less attention to a situation's demands and more on irrelevant situational characteristics (Bell & Calkins, 2012; Leve et al., 2013; Vaish, Grossmann, & Woodward, 2008). This narrowing or withdrawal of attention from important aspects of the environment may reveal itself through more local or focused information processing, less active exploration, reduction in the attention to novel stimuli and events, or diminished motivation to engage (Lewis, 1993a; Wilson & Gottman, 1996). This can lead to either reduced or complete failure to encode critical situational information. If information is not encoded, it cannot be remembered (Davis & Levine, 2013). For instance, studies examining

infant habituation report that fearful or distressed infants demonstrate proportionally lower looking times require more trials to habituate, take longer to meet learning criterions, and forget more after a delay than less negative infants (Fagen & Prigot, 1993; Rieser-Danner, 2003). Furthermore, decreases in negative affect relate to improvements in performance and learning (Angulo-Barroso et al., 2017), potentially because negative emotions compete for an individual's attentional capacity, limiting the ability to engage effectively in subsequent tasks (Keenan, 2002). What appears to be critical in most studies is that individual differences in temperament may underlie the associations between negative emotion and cognitive task performance.

Both concurrent and longitudinal works support the role of negative temperament in emotion–cognition interaction. For example, temperamentally fearful 12-month-olds complete fewer successful trials during an object permanence assessment compared to non-fearful infants (Rieser-Danner, 2003), and cross-lagged analyses from 5 months to 4 years of age reveal that children high on early temperamental shyness score lower on a composite of various assessments of EFs (Wolfe, Zhang, Kim-Spoon, & Bell, 2014). Leve and colleagues (2013) examined the effects of early and developing negative emotion reactivity on measures of EFs in later toddlerhood. Growth of negative emotion reactivity from 9 to 27 months of age was associated with lower levels of toddler EFs. Overly negative reactive infants may find it difficult to shift attention to other non-arousing stimuli or to other situational information that may allow them to focus and perform more efficiently. Clearly, more temperament and longitudinal research in infancy is needed to better understand the potential relations between infant negative emotion reactivity and cognitive performance and later competence. However, these findings are consistent with work with older children and adults, suggesting that negative emotion compromises later attentional and cognitive processes as well as academic achievement (Blanchette & Richards, 2010; Else-Quest, Hyde, & Hejmadi, 2008; Lewis et al., 2009).

Negative emotions from emotion induction Researchers who utilize emotion induction in early childhood through adolescence report decreases in IC performance, as well as greater cortical activation and demand of cortical resources in negative emotion conditions compared to nonemotional conditions (Lamm & Lewis, 2010; Lewis et al., 2006). Children may try to recruit additional attentional and cognitive resources when experiencing negative emotions but may be unsuccessful in redirecting their attentional resources. These empirical findings and rationalizations are in accordance with the "resource allocation model" (Ellis & Ashbrook, 1988). In this model, difficulties with problem-solving and cognitive performance are considered to be the product of emotions (including negative emotions). Emotions produce irrelevant thoughts and interference, thus increasing the allocation of attention away from the task at hand. This places a heavy burden on attention and memory resources (Ellis & Ashbrook, 1988; Tornare, Cuisinier, Czajkowski, & Pons, 2017) that are not fully developed until later adulthood. While this research supports the negative effects of high negative emotion on executive function, a recent meta-analysis calls for more studies, especially in early childhood (Moran, 2016). Such research may help elucidate the mechanism underlying cognition–emotion interaction in not only specific executive attention and memory tasks but also in later more cognitively complex contexts.

Positive Emotions

Fredrickson (2004) suggests that positive emotions play a significant role in cognitive abilities by broadening our awareness and encouraging novel, varied, and exploratory thoughts and actions. The "broaden-and-build" theory maintains that positive emotions allow a wider range of thoughts and prompt more creative courses of action, which in turn builds long-term intellectual resources for learning (Fredrickson, 2001; Fredrickson & Branigan, 2005). Indeed, positive emotions in adults have been found to facilitate and direct attention to increase receptiveness and to process information more holistically and con-

structively as well as engage in more novel experiences (Compton, Wirtz, Pajoumand, Claus, & Heller, 2004; Fredrickson, 2013; Isen, 2008).

Positive emotions from emotion induction Through the utilization of emotion induction methodologies, positive affect has been linked with elaboration and innovative thinking in children. In 4–14-year-olds, greater picture-memory performance, cognitive flexibility in problem-solving tasks, and math performance was reported when experiencing happiness compared to neutral or sad emotions (Bryan & Bryan, 1991; Greene & Noice, 1988; Masters, Barden, & Ford, 1979; Rader & Hughes, 2005; Terwogt, 1986) supporting that positive emotion generally promotes a broader activation of concepts in memory (Isen, Daubman, & Nowicki, 1987).

Positive emotions from a temperament perspective Although induction studies are informative, naturalistic observations and measures of overall temperamental emotionality are also needed in order to fully understand the critical role of positive emotion on cognitive outcomes. Piaget (1954/1981) observed that children who were more enthusiastic learned more easily, thus linking positive emotion to cognitive competence in infancy (Rieser-Danner, 2003). Though this literature is scarce in infancy, neurological theories support association between positive emotion and cognitive capabilities. The "dopaminergic theory of positive affect" assumes that during periods of positive affect, there is an increased release of dopamine in the brain which leads to more open, careful, and thorough processing and addressing of important information (for a review see Ashby, Isen, & Turken, 1999). This in turn produces more efficient decision-making and problem-solving (Ashby et al., 1999; Isen, 2001). Thus, children who are more prone to positive affect experience more efficient cognitive processing. This theory assumes that projections from the ventral tegmentum area into the PFC and ACC are especially important as they provide a direct mechanism through which individual differences in positive emotion can influence cognition. Increases in dopamine have shown to facilitate WM in the prefrontal cortex and executive attention in the ACC in both animal and clinical models (Brown & Marsden, 1988; Sawaguchi & Goldman-Rakic, 1991; Williams & Goldman-Rakic, 1995). The theory further implies that the resulting elevated dopamine levels influences performance on not only WM and attention but also cognitive flexibility, episodic memory, and creative problem-solving (Ashby et al., 1999).

Contradictory Findings

Although these previous studies coincide with several theoretical assumptions that depict negative affect as detrimental for cognition while positive emotions facilitate cognitive processes, research also shows complex and contradictory effects on cognition with both positive and negative emotions sometimes hindering and promoting cognitive performance.

Negative emotions For example, Rieser-Danner (2003) argues that negative emotions like fear increase attention to certain task-irrelevant stimuli, which reduces the degree of involvement in an immediate task, but may not be indicative of detrimental effects to the development of cognitive competence. Because novelty produces high levels of fear in behaviorally inhibited children and adolescents (individuals with a lower threshold to novelty and high levels of avoidance and withdrawal), they tend to express heightened levels of attentional vigilance and orienting (Fox, Henderson, Marshall, Nichols, & Ghera, 2005; Kagan, Reznick, Clarke, Snidman, & Garcia-Coll, 1984; Morales, Taber-Thomas, & Pérez-Edgar, 2017). Moreover, early behavioral inhibition to novelty has been linked to better inhibitory control in later preschool (Aksan & Kochanska, 2004). Nevertheless, behavioral inhibition is also believed to limit both the quantity and quality of children's experiences, particularly in novel contexts and/or with unfamiliar others, with some studies suggesting that behavioral inhibition (or shyness) is related to poorer EFs (Blankson et al., 2013; Henderson, Pine, & Fox, 2015; Wolfe et al., 2014).

The "affect-as-information" model, however, suggests that emotions not only provide information but also influence how people process information by either fostering more of an analytical, bottom-up processing style with considerable attention to details or less effortful, top-down processing (Schwarz, 2012). Specifically, negative affect in this model signals threat and results in vigilance and increased engagement (Schwarz, 1990). Perhaps, that is why some researchers have reported that infant distress predicts higher sensorimotor and WM scores (Bell, 2012; Lewis, 1993b). Similarly, longitudinal work has shown these counterintuitive results with early distress positively predicting WM and intelligence test performance (Karrass & Braungart-Rieker, 2004). Infants who are more negative might reflect a more precocious cognitive level than those who do not show such distress and may more readily and easily recognize when a stimulus or event is discrepant with something earlier experienced. This is vital for the development of more complex cognitive abilities later in life (Bell & Diaz, 2012; Karrass & Braungart-Rieker, 2004). The controversy remains whether or not negative affectivity interferes with an infant's ability to explore and learn about the environment (Ruff & Rothbart, 1996) or whether it brings more opportunities for cognitive development (Karrass & Braungart-Rieker, 2004).

Similar controversies exist in research with older children. For example, Farbiash and Berger (2016) reported that negative emotional experience resulted in better IC both behaviorally and physiologically. Specifically, kindergartens performed better if they expressed more negative emotions during a Go/NoGo task. Better performance coincided with larger fronto-central EEG theta power, which is evident during better conflict detection and conflict processing (Nigbur, Ivanova, & Stürmer, 2011; Tzur & Berger, 2007). Furthermore, empirical evidence also demonstrates a positive association between negative affect and better decision-making skills in preschoolers (Garon & Moore, 2006). This may be because it is a negative emotion, not a positive emotion, which is related to increases in attention, greater focusing, and the ability to ignore irrelevant stimuli to both process information better and think more analytically (Forgas, 2001, 2008). Similar findings are reported when examining EFs, engagement, and academic skills (Denham, Bassett, Sirotkin, & Zinsser, 2013; Diaz et al., 2017; Hernández et al., 2016).

Positive emotions A review of the adult literature on positive affect suggests that high-intensity positive affect is associated with narrowing of attention (Gable & Harmon-Jones, 2010). Several researchers claim that positive affect signals a safe environment or emerges when one is progressing faster than expected toward a goal, which may result in increases in disengagement, as well as a reliance on more heuristic, global, and synthetic processing of information that triggers more interference and deficits of thought and performance (Carver et al., 1999; Clore & Palmer, 2009). Denham et al. (2013) have also argued that positivity reduces the resources available to children to carry out executive control tasks or may interfere with children's ability to concentrate on cognitive tasks especially if they perceive them as dull, effortful, or not intrinsically enjoyable. This reasoning is consistent with the iterative reprocessing model which suggests that situations eliciting strong avoidance or approach can impair EFs (Zelazo & Cunningham, 2007; Zelazo, Qu, & Kesek, 2010) and that both positive and negative states can increase cognitive resource load and negatively affect the amount of resources left for thinking, learning, and action (Conway & Stifter, 2012).

Cognition, Emotion, and Self-Regulation

Over a decade ago, we recognized the need to integrate the traditionally disparate areas of cognition and emotion as we pursued an understanding of the development of EFs, such as WM and IC (Bell & Wolfe, 2004). We proposed that cognition and emotion, traditionally considered as separate processes, are dynamically linked and work together to process information and execute action. We suggested that the

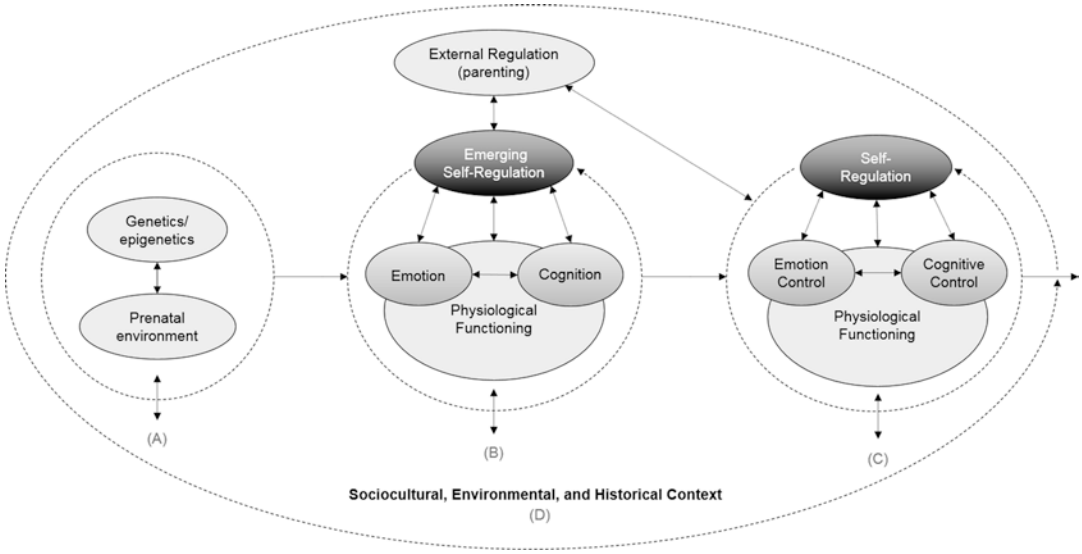

Fig. 1 A developmental psychobiological model of self-regulation

regulatory aspects of development can best be understood by investigations that conceptualize relations between emotion and cognition (Bell, 2012; Bell & Diaz, 2012; Bell, Kraybill, & Diaz, 2014; Wolfe & Bell, 2007).

As such, we consider developing cognition–emotion relations within the larger context of self-regulation, a construct with many definitions in the psychological literature (Vohs & Baumeister, 2004). We define self-regulation as conscious efforts to control one's inner states or responses with respect to thoughts, emotions, attention, and performance (Baumeister & Vohs, 2004). Thus, our conceptualizations of cognition and emotion might better be described as individual differences in "cognitive control" (EF) and "emotion control" (emotion regulation, ER). Within our self-regulation framework, we focus on physiological processes associated with attentional control as the mechanism for developing cognition–emotion relations. EF and ER have been conceptually and developmentally linked to attentional control (Bell & Calkins, 2012; Bell & Wolfe, 2007; Calkins & Fox, 2002). In both the neuropsychology and temperament literature, efforts to integrate cognitive and emotional development have been most successful within a biologically based developmental framework (Bell & Deater-Deckard, 2007; Bell & Wolfe, 2004; Calkins & Marcovitch, 2010). Our model of self-regulation is shown in Fig. 1. We briefly describe each of the four components to our model.

Component A represents the coactive contributions from the genome/epigenome and the prenatal environment; Component B represents the processes of emerging self-regulation skills from infancy to early childhood with a notable, bidirectional/coactive role of the caregiving environment/parenting; Component C conceptualizes the child's currently observable and measurable self-regulation as an emergent and reciprocally active factor given the child's current cognitive, emotional, and physiological functioning, recognizing the continuing, bidirectional/coactive association between parenting and child development; and finally, the collection of these dynamic, developmental factors are considered within Component D representing the context of the testing situation, as well as the broader sociocultural context, the environment, and the complex historical network of these factors across time.

Genetics, Epigenetics, and the Prenatal Environment

Component A of our model represents the earliest and most rapid period of development, from

conception through birth, characterized by the activity of the child's genome and epigenome within the reciprocally influential context of the prenatal environment. From our psychobiological perspective, we argue that a developmental account of self-regulation, including higher-order cognitive processing and emotion regulation, cannot be complete without consideration or acknowledgment of these factors.

Genes undeniably play a role in development, and twin and adoption studies suggest a significant contribution from genes to the prediction of higher-order cognition and EFs, a key component of our self-regulation model (Engelhardt, Briley, Mann, Harden, & Tucker-Drob, 2015; Friedman et al., 2008; Logue & Gould, 2014). Further, new and exciting research exists demonstrating the environmental contributions to such cognitive—and other—processes through epigenetic mechanisms, such as DNA methylation and histone remodeling (Ibrahim, Sutherland, Haupt, & Giffiths, 2017). In fact, many associations between the prenatal environment and later developmental outcomes, such as early exposure to stress and later dysregulation of the HPA axis, as described below, as well as prenatal/early malnutrition and later health outcomes are explained by changes to the epigenome (e.g., Murgatroyd & Spengler, 2011; Tobi et al., 2018).

The complex and dynamic, yet reliable, progression of nervous system development begins at conception with the proliferation of nerve cells (neurons and glia), a rapid process producing 250,000 cells per minute at its peak. Neurogenesis is followed systematically by the processes of migration, programmed cell death, myelination, synaptogenesis, dendritic arborization, and axonal growth. Although these processes are most robust and dynamic prior to birth, most of them continue throughout the childhood and adolescent years (Giedd, 1999). Given the complexity, intricacy, and speed with which prenatal development occurs, periods of sensitivity and vulnerability to perturbations and alterations in the environment exist; thus, the quality and status of the prenatal environment are critically important.

Maternal health and lifestyle factors during pregnancy, for example, have profound effects on the developmental outcomes of children. Disadvantageous physical, cognitive, and socioemotional outcomes have been linked with maternal diet and nutrition, drug use, physical health status and obesity, and stress and anxiety (e.g., Forray, 2016; Kofman, 2002; Lebel et al., 2012; Mina et al., 2017; Morgane et al., 1993; Prado & Dewey, 2014; Thompson, Levitt, & Stanwood, 2009; Walker et al., 2011). Maternal stress during pregnancy, in particular, has been associated with multiple and wide-ranging negative outcomes for offspring. These include alterations in neuroendocrine function and stress reactivity, brain structure and function, sleep behaviors, social behavior, and temperament; deficiencies in cognition, language, and EFs; as well as externalizing anxiety, impulsivity, and ADHD symptomology (Beydoun & Saftias, 2008; Blair, 2010; Buss, Davis, Hobel, & Sandman, 2011; Van den Bergh & Marcoen, 2004; Weinstock, 2001).

Modeling the process by which prenatal experiences may influence later development, the "fetal or perinatal programming hypothesis" suggests that negative events and exposures during critical periods of development may exert long-lasting organizing effects on the system, impacting growth and development and increasing the risk of adversity in childhood and beyond. Importantly, this hypothesis implicates the cascade of neuroendocrine responses triggered by stress as one such event or exposure (Beydoun & Saftias, 2008; Van den Bergh & Marcoen, 2004). Specifically, in response to real or perceived stress, the amygdala signals the hypothalamus to activate two stress response systems: a fast-acting pathway mediated by the sympathetic nervous system (SNS) and the release of epinephrine from the adrenal medulla and a slower pathway mediated by the hypothalamic-pituitary-adrenal (HPA) axis triggering the systematic release of stress-related hormones and ultimately the release of cortisol from the adrenal cortex. Prolonged or chronic stress is associated with the sustained activation of the HPA axis and thus the continuous exposure to stress-related hormones

which are known to have multiple negative effects on the body (e.g., sustained increased in metabolic processes, depletion of energy stores, suppression of the immune system, etc.; Kofman, 2002). Thus, unrelenting maternal stress during pregnancy may contribute to compromised physiological terrain of the mother and thus suboptimal conditions for the child—a circumstance that increases the risk of adversity for the mother and provides a disadvantageous context for the impressionable developing brain and nervous system.

Experimental research with animal models demonstrates that exposure to prenatal stress impacts many physiological and behavioral processes. For example, prenatal exposure alters baseline and stress responsivity of the HPA axis, levels, and distribution of regulatory neurotransmitters (e.g., norepinephrine, dopamine, serotonin, and acetylcholine), modifies brain structures (e.g., hippocampus, amygdala, corpus callosum, anterior commissure, cerebral cortex, cerebellum, and hypothalamus), and affects learning, anxiety, and social behavior (Charil, Laplante, Valillancourt, & King, 2010; see Kofman, 2002 for a review).

Building on such experimentally based animal models, well-designed longitudinal studies with humans support a causal argument, as well as for the role of prenatal exposure to stress on negative developmental outcomes. For example, one prospective longitudinal study with a typically developing sample of children found an association between maternal pregnancy-specific anxiety and measures of EFs in a sample of 6- to 9-year-old children and found lower IC performance in girls (Buss et al., 2011). Interestingly, for a subgroup of this sample, reduced gray matter volumes in the PFC, the medial temporal lobe, and other brain regions were associated with reports of high maternal pregnancy-specific anxiety early in gestation (Buss, Davis, Muftuler, Head, & Sandman, 2010). These results suggest that impaired regulatory processes, namely, EFs and specifically IC for girls, may be associated with the gray matter reductions in the PFC, an arguable consequence of maternal stress during critical periods of pregnancy.

An additional longitudinal study with significant control measures found an association between maternal stress during the first trimester of pregnancy and lower scores on the mental developmental index of the Bayley scales at 16–18 months of age, as well as scores indicating more difficult temperaments and poorer attention span and persistence (Zhu et al., 2014). The authors attribute their findings to the impact of maternal stress processes during a critical period for the developing brain, including the prefrontal cortex, hippocampus, and amygdala, and for the developing functionality of the HPA axis—processes that are sensitive to high concentrations of glucocorticoids (Zhu et al., 2014).

Further, prenatal experiences that include chronic exposure to stress and the resultant impact on the developing nervous system and stress-response physiology may help to explain why some infants and children are more sensitive to novel or threat-related environmental stimuli than others (e.g., LoBue & Pérez-Edgar, 2014; Pérez-Edgar et al., 2010). It is feasible to propose that those children who are more sensitive to particular environmental stimuli may have had prenatal experiences that were characterized by chronic maternal stress or other experiences that impacted their stress response physiology.

Emerging Self-Regulation and the Role of Parenting

Component B of our model conceptualizes the process of emerging self-regulation and represents the time from birth to early childhood. Importantly, this component assumes individual and self-continuity as well as the contribution of those proceeding processes, experiences, and contexts. Further, the bidirectional arrow connecting this component (and others) with the sociocultural, environmental, and historical context domain represents the reciprocal and coactive nature of these components. This second-stage component of the model highlights the involvement of the dynamic and developing, related physiological processes (e.g., PFC areas, autonomic functioning, HPA axis, etc.), the child's emotional reactivity and emerging regulation,

and the child's developing set of cognitive processes and skills. Each of these components is reciprocal, interdependent, and coactive. The illustration of physiological functioning as the largest or base element is purposeful as we are biological beings, and our emotions and cognitions are represented physiologically. In our model, we propose that self-regulation emerges from and is made possible by the action and coaction of one's cognitive processing (i.e., EFs) and emotion status (i.e., ER), which also are influenced and changed by the process and experiences of self-regulation. Finally, this component of the model includes an important and undeniable factor in the development and emergence of self-regulation—that is, forces of external regulation, namely, parenting.

Developmental changes in self-regulation are demonstrated as infants' progress from almost total dependence on caregivers for regulation to independent self-regulation of emotions and cognitions (Bell & Wolfe, 2007; Calkins & Hill, 2007). Early regulation is mostly influenced by innate physiological mechanisms (Kopp, 1982; Kopp & Neufeld, 2003; Thompson, Virmani, Waters, Raikes, & Meyer, 2013). Beginning around 3 months of age, some voluntary control of arousal is evident, with more purposeful control evident by 12 months, when developing motor skills and communication behaviors allow for interactions with caregivers. After the first birthday, infants begin to utilize language skills and increasing impulse control (Kopp, 1989), thus making the transition from passive to active (i.e., "self") methods of regulation. Individual differences in self-regulation are evident by age 4 (Kopp & Neufeld, 2003) and are likely related to the development of executive attention (Posner & Rothbart, 1998, 2007; Rothbart & Sheese, 2007).

As children develop toward active or self-regulation, parenting provides the scaffold for emerging regulatory skills. For example, longitudinal research shows that maternal attention directing behaviors at age 2 interact with child temperament to impact EF performance at 4 years of age (Conway & Stifter, 2012). Specifically, attention maintenance by mothers at age 2 had positive effects on EF in preschoolers with less moderate temperaments (i.e., inhibited and exuberant), and attention redirection strategies were detrimental to EF for those preschoolers who were inhibited. Other maternal parenting behaviors are also positively linked to later developing control processes. For example, Bernier, Carlson, and Whipple (2010) reported data from a community sample demonstrating that autonomy support and maternal mind-mindedness during infancy were associated with better EF performance in toddlerhood after controlling for IQ. These researchers suggested that responsive maternal behaviors during infancy may promote later child EF through neurological development of the frontal lobes. Indeed, parenting behaviors during infancy are linked with the development of EEG activity at frontal scalp locations, but not other scalp areas, during toddlerhood (Bernier, Calkins, & Bell, 2016).

In addition to relaying strategies and providing cognitive scaffolding, parent–child interactions afford children with skills to apply in similar situations in the future and give them skills to draw upon when needed to solve problems, maintain focus, and pursue goals despite emotional interference or even because of it. Skillful and sensitive parenting behaviors in complex, challenging, or emotionally difficult times help to regulate a child's anxiety (hence their stress response physiology), keeping arousal at a level that is beneficial and optimal rather than detrimental—causing a cascade of stress hormone release and a resultant decrease in PFC (and hippocampal) functioning (e.g., McEwen & Morrison, 2013).

Self-Regulation

Component C of our model represents the child's currently observable and measurable self-regulation as an emergent and reciprocally active factor given the child's current cognitive, emotional, and physiological functioning. Importantly, this component of the model recognizes one's history as well as one's "continuity within the context" of physiological functioning, emotion and cognitive processing,

and experiences with self-regulation, as well as the continued bidirectional/coactive association between parenting and child development.

Children with better regulatory skills may encounter and successfully manage challenging tasks in their environments more often and therefore have more opportunities to develop cognitive concepts and skills (Brophy-Herb, Zajicek-Farber, Bocknek, McKelvey, & Stansbury, 2013). Furthermore, self-regulation may be an important protective factor leading to better academic performance in children from low socioeconomic status or maltreatment backgrounds (Brophy-Herb et al., 2013; Schelble, Franks, & Miller, 2010). Although research is limited (Kwon, Hanrahan, & Kupzyk, 2017), the ability to regulate arousal may allow children to engage in and successfully negotiate challenging tasks that provide opportunities for using and practicing EFs and other necessary cognitive capabilities (Calkins & Dedmon, 2000).

Component C of our model can also be considered in the context of adolescence and adulthood, with changing importance placed on the influence of parenting to self-regulation. There are, however, potential transactional processes between generations such that the self-regulation of children may affect parent's own self-regulation (Bridgett, Burt, Edwards, & Deater-Deckard, 2015). Thus, intergenerational transmission of self-regulation suggests that some aspect of "parenting" affects self-regulation throughout the lifespan.

Sociocultural, Environmental, and Historical Context

Finally, each component of the model previously described is situated within a rich and vivid context. We intend Component D to include an acknowledgment of the broader sociocultural context, the local and nonlocal environments, and the complex historical network of these factors across time. This aspect of our model is least supported by empirical data with respect to research integrating cognition and emotion, but we are convinced it is critical to our understanding of the development of complex self-regulatory processes situated within a rich complex environment (Bronfenbrenner, 1989).

It may be that research on cognition–emotion and the academic environment can inform Component D of our model. Elementary school is a place where children must continually face heightened expectations for behavioral compliance, for sustained attention, and for emerging math and literacy skills (Farmer et al., 2002). The expression of negative emotion may diminish children's effort, motivation, participation in school, and enjoyment of school (Linnenbrink, 2007; Pekrun, 2006; Valiente, Lemery, & Castro, 2007). However, there is a limited work on affective dispositions and academic performance even though the theory suggests that individual differences in emotionality may influence cognition and adaptive functioning within the classroom (Gumora & Arsenio, 2002; Izard, Stark, Trentacosta, & Schultz, 2008; Pekrun, Elliot, & Maier, 2006). Specifically, negative emotions may lead to rumination over task-unrelated issues and decreases in the ability to concentrate on and accomplish specialized cognitive tasks (He & Yin, 2016). Moreover, Denham and colleagues (2012) suggest that children high in negative emotionality may not have the personal resources to focus on learning, whereas those children lower in negative emotionality, or who can maintain a positive emotional tone, might be able to remain engaged even in cognitively demanding environments such as the classroom. This is consistent with studies reporting that more withdrawn and reticent (a behavioral marker of shyness) children are less attentive and score significantly below their less shy peers on reading, on mathematics, and on global ratings of academic achievement (e.g., Hughes & Coplan, 2010; Rudasill & Kalutskaya, 2014). Generally, greater withdrawal and greater aggression relate to poorer academic performance (Brennan, Shaw, Dishion, & Wilson, 2012; Campbell, Spieker, Burchinal, Poe, & NICHD, 2006; Hall, Welsh, Bierman, & Nix, 2016). Evidence suggests that greater negative emotion arousal during routine classroom assignments, homework, and classroom activi-

ties impairs cognitive performance (He & Yin, 2016), not only in elementary school but also in high school (Klapp, 2016; Lewis et al., 2009).

However, the relation between emotion and cognition linked to academic outcome may not be a direct relationship. Hernández et al. (2016) found that negative emotions expressed in school predicted poorer school engagement via greater teacher–student conflict. Indeed, researchers have suggested that teachers seemed especially attuned to children's negative emotions (Valiente, Swanson, & Lemery-Chalfant, 2012). Highly negative children are often perceived by teachers as less attentive, persistent and eager to learn, and overall more difficult to teach (Denham et al., 2012; Ferrier, Bassett, & Denham, 2014; Hamre & Pianta, 2001; Keogh, 2003). This may lead to children receiving less feedback and instruction or poor experiences that lead to lower motivation or interest in achievement (Raver, 2004). In fact, there is a large body of literature pointing to the negative relation between negative emotion and social competence both within and outside the school context (Diaz et al., 2017; Dougherty, 2006; Eisenberg et al., 2000; Hernández et al., 2015; Valiente, Swanson, & Lemery-Chalfant, 2012). Thus, at least with research on the academic environment, the sociocultural and environmental context of cognition–emotion processes can be readily examined in children and adolescents.

Critical Areas for Future Research on Self-Regulation

We continue to think about Riley and Taylor and their experiences in our lab that day. They demonstrated strong self-regulation, an emergent property of their developing EFs, and their ability to successfully regulate their emotions and behavior, all of these subserved by the functioning of their physiological regulatory systems. But what other factors might have impacted their performance in the lab that day? That is, what other experiences or factors may have proceeded optimal cognitive, emotional, and physiological functioning? What experiences did Riley and Taylor have before they came to our lab that might have "primed" their mood and compliant behavior? What did they have for breakfast or lunch? How well did they sleep the night before? Did they have a nap today?

Our musing generated two factors that demonstrate reliable associations (predictive and concurrent, correlational and experimental) with the variables identified in our model. Incidentally, these are the same factors identified by kindergarten teachers (i.e., those experientially trained experts in child behavior, attention, cognition, and emotion regulation) when they were asked to rank the most desirable skills that children could possess in terms of school readiness. The teachers indicated first and foremost that they would like to see children "physically well-nourished and rested" (Blair & Raver, 2015, p. 713). Certainly, sleep and nutrition are undeniable factors that contribute to the rich, complex environment within which developing self-regulation is situated, and they have direct implications for the development of self-regulation through their consistently demonstrated associations with various aspects of cognitive, emotional, and physiological development.

Sleep and the Development of Self-Regulation

The importance of sleep for health and development cannot be denied, and the literature is replete with studies linking sleep to multiple outcomes in the developmental domains of cognition, emotion, and physiology (see Bub, Buckhalt, & El-Sheikh, 2011; El-Sheikh & Sadeh, 2015; Maski & Kothare, 2013; and Turnbull, Reid, & Morton, 2013, for reviews). Importantly, inadequate sleep seems to be particularly problematic for those behaviors that subserve the emergence of self-regulation in our currently presented model, namely, EFs, emotional reactivity/regulation, and physiological functioning (Bernier, Beauchamp, Bourvette-Turcot, Carlson, & Carrier, 2013; Dahl, 1996; Nelson, Nelson, Kidwell, James, & Espy, 2015;

Sadeh et al., 2015; Sadeh, Gruber, & Raviv, 2003). The vulnerability of these particular regulatory processes to inadequate sleep may be related to their association with the functioning of the prefrontal cortex, amygdala, and other brain regions that demonstrate effects of sleep deprivation (e.g., Drummond et al., 1999; Walker, 2009; Yoo, Gujar, Hu, Jolesz, & Walker, 2007). Sleep also seems to play an active role in the early development and maturation of these brain systems. It facilitates their rapidly developing microarchitecture and functional connectivity, preparing the brain for new learning and emotion processing, as well as optimal memory consolidation (Drummond et al., 1999; Giedd, 1999; Giedd et al., 1999; Walker, 2009). A fact that makes high-quality sleep particularly important during infancy and early childhood—the time highlighted in our model as being critically important for developing self-regulatory processes.

Other, albeit arguably related, explanations have been offered for the associations between sleep and EFs and emotion regulation. For example, high-quality sleep may enhance daytime alertness or decrease fatigue allowing for optimal performance on challenging, effortful tasks of cognition of emotion processing (Sadeh, 2007; Turnbull et al., 2013; Walker, 2009). Further, a reciprocal and bidirectional nature of influence between sleep and regulatory behaviors exists, as a less developed capacity for cognitive and behavioral self-regulation could lead to difficulties adhering to a bedtime routine or self-soothing during nighttime wakings (Turnbull et al., 2013). Finally, as previously noted, the role of the caregiver in the context of these developing regulatory systems cannot be ignored (Sadeh et al., 2015); just as parents play a role in the developing attention systems and emotional regulation of their children, they also play a role in regulating the sleep behaviors and processes of the child.

Nutrition and the Development of Self-Regulation

Like sleep, nutrition undeniably plays an important role in child health and development. A significant literature demonstrates the negative impact of malnutrition and nutrient deficiencies on the brain. Cognitive and emotion regulation development highlight the benefits of breastfeeding, regular consumption of breakfast, and micronutrient intake (e.g., omega-3 fatty acids, vitamin B12, folic acid, iodine, etc.; Bell, Ross, & Goodman, 2016; Colombo et al., 2004; Jones, McFall, & Diego, 2004; Kannass, Colombo, & Carlson, 2009; Nyaradi, Li, Hickling, Foster, & Oddy, 2013; Prado & Dewey, 2014). Positive links have been found in studies examining longer-term associations of healthy diet consumption (e.g., plentiful fruits and vegetables, whole grains, and proteins; limited sweets, salty snacks, and beverages) and EFs, specifically (Cohen, Gorski, Gruber, Kurdziel, & Rimm, 2016).

Recently, there has been an interest in exploring the complex and intricate relation between the digestive system and the brain with a particular focus on the gut microbiome (i.e., the bacterial composition of the gut, including its genome). The gut microbiota is understood to play a significant role in the brain and behavior and to impact the health and development of the host, including nervous system development and function (Cenit, Nuevo, Codoner-Franch, Dinan, & Sanz, 2017; Dinan & Cryan, 2015; Ly et al., 2017; Mayer, 2011; O'Mahony, Clarke, Dinan, & Cryan, 2015). Substantial communicative associations between the gut and brain exist that include their mutual connections with the vagus nerve, immune system function, metabolic processes, and neurotransmitter levels regulated by the gut microbiome (Cenit et al., 2017; Dinan & Cryan, 2015; Ly et al., 2017).

Gastrointestinal problems—including alterations of gut microbiota—are noted in developmental disorders that manifest with atypical patterns of attention, EFs, emotion reactivity/regulation, and social interaction (McElhanon, McCracken, Karpen, & Sharp, 2014), such as autism spectrum disorder (ASD; Adams, Johansen, Powell, Quig, & Rubin, 2011; Dinan & Cryan, 2015) and attention deficit hyperactivity disorder (ADHD; Ly et al., 2017). Elimination diets that attempt to reduce inflammation and immune system reactivity and improve diversity

and quantity of healthy bacteria in the gut (e.g., diets free of gluten, casein, sugar, common allergens, food additives/preservatives, etc.) demonstrate relative success with symptom improvement for these populations (e.g., Konikowska, Regulska-Ilow, & Rozanska, 2012; Ly et al., 2017).

Further, the microbiome has been causally associated with normal development and regulation of stress response physiology in animal models, such that abnormalities in microbiota lead to exaggerated HPA axis responses to a stressor—notably, a response that was reversed with the normal bacterial colonization established (Sudo et al., 2004). In humans, many prenatal and perinatal experiences (e.g., maternal stress, infections, and obesity during pregnancy; mode of delivery, gestational age, and whether breastfed or not) are associated with the microbiota of the child (Cenit et al., 2017). From this perspective, it may be important to reconsider the association between maternal stress during pregnancy and suboptimal developmental outcomes for the child—particularly those outcomes including structural and functional changes within the brain and dysregulation of the HPA axis. Indeed, one mechanism by which maternal stress may influence child outcomes is that the cascade of stress-related hormones continually released by the mother alters her own microbiota and that has significant implications for the microbial assembly of the developing child (Cenit et al., 2017).

Although more research is needed to establish causality in these gut–brain mechanisms in humans as well as their role in typical as well as atypical development, it is clear that this area of research includes factors that should be considered when the goal is optimal development of our cognitive, emotion, and physiological regulatory systems. Thus, we propose that any research endeavor attempting to understand the processes of self-regulation from a developmental psychobiological perspective must also include an acknowledgement of these health status factors, as they impact the physiological functioning—and thus cognitive processing, emotion processing, and ultimately the process of self-regulation.

Conclusion

In this chapter, we have argued that cognition must be considered alongside emotion in any comprehensive examination of development in childhood and beyond and that self-regulation is the ideal framework for integrating cognition and emotion processes. We acknowledge that emotion on its own encompasses multiple complex mechanisms. To simplify emotion by reducing its examination to individual component behaviors, or to silo emotion into a separate field of study, however, fails to capture an informative view of emotion development. It fails to capture the psychobiological view that cognition and emotion are intricately bound (Bell & Wolfe, 2004); that cognition and emotion result from complex, multileveled, inseparable physical, biological, and social environments with which the individual interacts throughout development (Bell, 2015). In our dataset, Riley and Taylor have similar day–night task scores for their visits to our lab. We know, however, that they each achieved their scores in very different ways by calling on the self-regulatory mechanisms they had been developing in their own multileveled, rich environments. In other words, they integrated their cognitive and emotion processes.

References

Adams, J. B., Johansen, L. J., Powell, L. D., Quig, D., & Rubin, R. A. (2011). Gastrointestinal flora and gastrointestinal status in children with autism--comparisons to typical children and correlation with autism severity. *BMC Gastroenterology, 11*(22), 1–13.

Aksan, N., & Kochanska, G. (2004). Links between systems of inhibition from infancy to preschool years. *Child Development, 75*(5), 1477–1490.

Angulo-Barroso, R. M., Peciña, S., Lin, X., Li, M., Sturza, J., Shao, J., & Lozoff, B. (2017). Implicit learning and emotional responses in nine-month-old infants. *Cognition and Emotion, 31*(5), 1031–1040.

Arain, M., Haque, M., Johal, L., Mathur, P., Nel, W., Rais, A., … Sharma, S. (2013). Maturation of the adolescent brain. *Neuropsychiatric Disease and Treatment, 9*, 449–461.

Ashby, F. G., Isen, A. M., & Turken, A. U. (1999). A neuropsychological theory of positive affect and its influence on cognition. *Psychological Review, 106*(3), 529–550.

Babkirk, S., Rios, V., & Dennis, T. A. (2015). The late positive potential predicts emotion regulation strategy use in school-aged children concurrently and two years later. *Developmental Science, 18*(5), 832–841.

Banfield, J. F., Wyland, C. L., Macrae, C. N., Munte, T. F., & Heatherton, T. F. (2004). The cognitive neuroscience of self-regulation. In *Handbook of self-regulation: Research, theory, and applications* (pp. 62–83). New York, NY: Guilford Press.

Baumeister, R. F., & Vohs, K. K. (2004). *Handbook of self-regulation: Research, theory, and applications*. New York, NY: Guilford.

Bell, M. A. (2002). Infant 6-9 Hz synchronization during a working memory task. *Psychophysiology, 39*, 450–458.

Bell, M. A. (2012). A psychobiological perspective on working memory performance at 8 months of age. *Child Development, 83*(1), 251–265.

Bell, M. A. (2015). Bringing the field of infant cognition and perception toward a biopsychosocial perspective. In S. D. Calkins (Ed.), *Handbook of infant development: A biopsychosocial approach* (pp. 27–37). New York, NY: Guilford Press.

Bell, M. A., & Calkins, S. D. (2012). Attentional control and emotion regulation in early development. In M. I. Posner (Ed.), *Cognitive neuroscience of attention* (2nd ed., pp. 322–330). New York, NY: Guilford Press.

Bell, M. A., & Deater-Deckard, K. (2007). Biological systems and the development of self-regulation: Integrating behavior, genetics, and psychophysiology. *Journal of Developmental & Behavioral Pediatrics, 28*, 409–420.

Bell, M. A., & Diaz, A. (2012). EEG/ERP measures of emotion–cognition integration during development. *Monographs of the Society for Research in Child Development, 77*, 8–16.

Bell, M. A., Kraybill, J. H., & Diaz, A. (2014). Reactivity, regulation, and remembering: Associations between temperament and memory. In P. J. Bauer & R. Fivush (Eds.), *Handbook on the development of children's memory* (Vol. 2, pp. 671–687). Malden, MA: Wiley-Blackwell.

Bell, M. A., Ross, A. P., & Goodman, G. (2016). Assessing infant cognitive development after prenatal iodine supplementation. *American Journal of Clinical Nutrition, 104*, 928s–934s.

Bell, M. A., & Wolfe, C. D. (2004). Emotion and cognition: An intricately bound developmental process. *Child Development, 75*, 366–370.

Bell, M. A., & Wolfe, C. D. (2007). The cognitive neuroscience of early socioemotional development. In C. A. Brownell & C. B. Kopp (Eds.), *Socioemotional development in the toddler years* (pp. 345–369). New York, NY: Guilford.

Bernier, A., Beauchamp, M. H., Bourvette-Turcot, A. A., Carlson, S. M., & Carrier, J. (2013). Sleep and cognition in preschool years: Specific links to executive functioning. *Child Development, 84*(5), 1542–1553.

Bernier, A., Calkins, S. D., & Bell, M. A. (2016). Longitudinal associations between the quality of maternal parenting behavior and brain development across infancy. *Child Development, 87*, 1159–1174.

Bernier, A., Carlson, S. M., & Whipple, N. (2010). From external regulation to self-regulation: Early parenting precursors of young children's executive functioning. *Child Development, 81*, 326–339.

Beydoun, H., & Saftias, A. F. (2008). Physical and mental health outcomes of prenatal maternal stress in human and animal studies: A review of recent evidence. *Pediatric and Perinatal Epidemiology, 22*, 438–466.

Blair, C. (2002). School readiness: Integrating cognition and emotion in a neurobiological conceptualization of child functioning at school entry. *American Psychologist, 57*(2), 111–127.

Blair, C. (2010). Stress and the development of self-regulation in context. *Child Development Perspectives, 4*(3), 181–188.

Blair, C., Calkins, S. D., & Kopp, L. (2010). Self-regulation as the interface of emotional and cognitive development: Implications for education and academic achievement. In *Handbook of personality and self-regulation* (pp. 64–90). New York, NY: Wiley.

Blair, C., & Raver, C. C. (2015). School readiness and self-regulation: A developmental psychobiological approach. *Annual Review Psychology, 66*, 711–731.

Blanchette, I., & Richards, A. (2010). The influence of affect on higher level cognition: A review of research on interpretation, judgement, decision making and reasoning. *Cognition & Emotion, 24*(4), 561–595.

Blankson, A. N., O'Brien, M., Leerkes, E. M., Marcovitch, S., Calkins, S. D., & Weaver, J. M. (2013). Developmental dynamics of emotion and cognition processes in preschoolers. *Child Development, 84*(1), 346–360.

Bornstein, M. H., & Putnick, D. L. (2012). Cognitive and socioemotional caregiving in developing countries. *Child Development, 83*(1), 46–61.

Brennan, L. M., Shaw, D. S., Dishion, T. J., & Wilson, M. (2012). Longitudinal predictors of school-age academic achievement: Unique contributions of toddler-age aggression, oppositionality, inattention, and hyperactivity. *Journal of Abnormal Child Psychology, 40*(8), 1289–1300.

Bridgett, D. J., Burt, N. M., Edwards, E. S., & Deater-Deckard, K. (2015). Intergenerational transmission of self-regulation: A multidisciplinary review and integrative conceptual framework. *Psychological Bulletin, 141*(3), 602–654.

Bridgett, D. J., Oddi, K. B., Laake, L. M., Murdock, K. W., & Bachmann, M. N. (2013). Integrating and differentiating aspects of self-regulation: Effortful control, executive functioning, and links to negative affectivity. *Emotion, 13*(1), 47–63.

Bronfenbrenner, U. (1989). Ecological systems theory. In R. Vasta (Ed.), *Annals of child development: Vol. 6 six theories of child development: Revised formulations and current issues* (pp. 187–249). Greenwich, CT: JAI Press.

Brophy-Herb, H. E., Zajicek-Farber, M. L., Bocknek, E. L., McKelvey, L. M., & Stansbury, K. (2013).

Longitudinal connections of maternal supportiveness and early emotion regulation to children's school readiness in low-income families. *Journal of the Society for Social Work and Research, 4*(1), 2–19.

Brown, R. G., & Marsden, C. D. (1988). Internal versus external cues and the control of attention in Parkinson's disease. *Brain: A Journal of Neurology, 111*(Pt 2), 323–345.

Bryan, T., & Bryan, J. (1991). Positive mood and math performance. *Journal of Learning Disabilities, 24*(8), 490–494.

Bub, K. L., Buckhalt, J. A., & El-Sheikh, M. (2011). Children's sleep and cognitive performance: A cross-domain analysis of change over time. *Developmental Psychology, 47*, 1504–1514.

Bush, G., Luu, P., & Posner, M. I. (2000). Cognitive and emotional influences in anterior cingulate cortex. *Trends in Cognitive Sciences, 4*(6), 215–222.

Buss, C., Davis, E. P., Hobel, C. J., & Sandman, C. A. (2011). Maternal pregnancy-specific anxiety is associated with child executive function at 6-9 years age. *Stress, 14*(6), 665–676.

Buss, C., Davis, E. P., Muftuler, T., Head, K., & Sandman, C. A. (2010). High pregnancy anxiety during mid-gestation is associated with decreased gray matter density in 6-9 year old children. *Psychoneuroendocrinology, 35*(1), 141–153.

Calkins, S. D. (2011). Caregiving as coregulation: Psychobiological processes and child functioning. In A. Booth, S. M. McHale, & N. S. Landale (Eds.), *Biosocial foundations of family processes* (pp. 49–59). New York, NY: Springer.

Calkins, S. D. (2015). *Handbook of infant development: A biopsychosocial approach*. New York, NY: Guilford Press.

Calkins, S. D., & Dedmon, S. E. (2000). Physiological and behavioral regulation in two-year-old children with aggressive/destructive behavior problems. *Journal of Abnormal Child Psychology, 28*(2), 103–118.

Calkins, S. D., & Hill, A. (2007). Caregiver influences on emerging emotion regulation: Biological and environmental transactions in early development. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 229–248). New York, NY: Guilford.

Calkins, S. D., & Marcovitch, S. (2010). Emotion regulation and executive functioning in early development: Mechanisms of control supporting adaptive functioning. In S. D. Calkins & M. A. Bell (Eds.), *Child development at the intersection of emotion and cognition* (pp. 37–57). Washington, DC: American Psychological Association.

Calkins, S.D., & Fox, N.A. (2002). Self-regulatory processes in early personality development: A multilevel approach to the study of childhood social withdrawal and aggression. *Development and Psychopathology, 14*, 477–498.

Campbell, S. B., Spieker, S., Burchinal, M., Poe, M. D., & NICHD Early Child Care Research Network. (2006). Trajectories of aggression from toddlerhood to age 9 predict academic and social functioning through age 12. *Journal of Child Psychology and Psychiatry, 47*(8), 791–800.

Campos, J., Barrett, K., Lamb, M., Goldsmith, H., & Stenberg, C. (1983). Socioemotional development. In M. Haith & J. Campos (Eds.), *Infancy and developmental psychobiology. Vol. II. Handbook of child psychology*. New York, NY: Wiley.

Carlson, S. M. (2005). Developmentally sensitive measures of executive function in preschool children. *Developmental Neuropsychology, 28*(2), 595–616.

Carlson, S. M., & Wang, T. S. (2007). Inhibitory control and emotion regulation in preschool children. *Cognitive Development, 22*(4), 489–510.

Carver, C.S., Lawrence, J.W., & Scheier, M.F. (1999). Self-discrepancies and affect: Incorporating the role of feared selves. *Personality and Social Psychology Bulletin, 25,* 783–792.

Casey, B. J., Jones, R. M., & Somerville, L. H. (2011). Braking and accelerating of the adolescent brain. *Journal of Research in Adolescence, 21*(1), 21–33.

Cenit, M. C., Nuevo, I. C., Codoner-Franch, P., Dinan, T. G., & Sanz, Y. (2017). Gut microbiota and attention deficit hyperactivity disorder: New perspectives for a challenging condition. *European Child & Adolescent Psychiatry, 26*(9), 1081–1092.

Charil, A., Laplante, D. P., Valillancourt, C., & King, S. (2010). Prenatal stress and brain development. *Brain Research Reviews, 65*, 56–79.

Choi, E., & Song, H. (2014). The influences of effortful control and working memory on emotion regulation in preschool children: The analysis of moderating effect of child sex. *Korean Journal of Child Studies, 35*(6), 65–78.

Clore, G. L., & Palmer, J. E. (2009). Affective guidance of intelligent agents: How emotion controls cognition. *Cognitive Systems Research, 10*(1), 21–30.

Cohen, J. F. W., Gorski, M. T., Gruber, A., Kurdziel, L. B. F., & Rimm, E. B. (2016). The effect of healthy dietary consumption on executive cognitive functioning in children and adolescents: A systematic review. *British Journal of Nutrition, 116*, 989–1000.

Cole, C. E., Zapp, D. J., Fettig, N. B., & Pérez-Edgar, K. (2016). Impact of attention biases to threat and effortful control on individual variations in negative affect and social withdrawal in very young children. *Journal of Experimental Child Psychology, 141*, 210–221.

Cole, P. M., Martin, S. E., & Dennis, T. A. (2004). Emotion regulation as a scientific construct: Methodological challenges and directions for child development research. *Child Development, 75*(2), 317–333.

Colombo, J., Kannass, K. N., Shaddy, D. J., Kundurthi, S., Maikranz, J. M., … Carlson, S. E. (2004). Maternal DHA and the development of attention in infancy and toddlerhood. *Child Development, 75*, 1254–1267.

Compton, R. J., Wirtz, D., Pajoumand, G., Claus, E., & Heller, W. (2004). Association between positive affect and attentional shifting. *Cognitive Therapy and Research, 28*(6), 733–744.

Conway, A., & Stifter, C. A. (2012). Longitudinal antecedents of executive function in preschoolers. *Child Development, 83*(3), 1022–1036.

Cuevas, K., & Bell, M. A. (2010). Developmental progression of looking and reaching performance on the A-not-B task. *Developmental Psychology, 46*, 1363–1371.

Dahl, R. E. (1996). The regulation of sleep and arousal: Development and psychopathology. *Development and Psychopathology, 8*, 3–27.

Dahl, R. E. (2001). Affect regulation, brain development, and behavioral/emotional health in adolescence. *CNS Spectrums, 6*(1), 60.

Davis, E. L., & Levine, L. J. (2013). Emotion regulation strategies that promote learning: Reappraisal enhances children's memory for educational information. *Child Developmental, 84*(1), 361–374.

Deater-Deckard, K. (2014). Family matters: Intergenerational and interpersonal processes of executive function and attentive behavior. *Current Directions in Psychological Science, 23*(3), 230–236.

DeCicco, J. M., O'Toole, L. J., & Dennis, T. A. (2014). The late positive potential as a neural signature for cognitive reappraisal in children. *Developmental Neuropsychology, 39*(7), 497–515.

DeCicco, J. M., Solomon, B., & Dennis, T. A. (2012). Neural correlates of cognitive reappraisal in children: An ERP study. *Developmental Cognitive Neuroscience, 2*(1), 70–80.

Denham, S. A., Bassett, H. H., Sirotkin, Y. S., & Zinsser, K. (2013). Head start preschoolers' emotional positivity and emotion regulation predict their social-emotion behavior, classroom adjustment, and early school success. *NHSA Dialog, 16*(2), 18–33.

Denham, S. A., Bassett, H. H., Thayer, S. K., Mincic, M. S., Sirotkin, Y. S., & Zinsser, K. (2012). Observing preschoolers' social-emotional behavior: Structure, foundations, and prediction of early school success. *The Journal of Genetic Psychology, 173*(3), 246–278.

Dennis, T. A. (2010). Neurophysiological markers for child emotion regulation from the perspective of emotion–cognition integration: Current directions and future challenges. *Developmental Neuropsychology, 35*(2), 212–230.

Dennis, T. A., & Hajcak, G. (2009). The late positive potential: A neurophysiological marker for emotion regulation in children. *Journal of Child Psychology and Psychiatry, 50*(11), 1373–1383.

Diamond, A. (2006). The early development of executive functions. *Lifespan Cognition:Mechanisms of Change, 210*, 70–95.

Diamond, A. (2013). Executive functions. *Annual Review of Psychology, 64*, 135–168.

Diamond, A., & Lee, K. (2011). Interventions shown to aid executive function development in children 4 to 12 years old. *Science, 333*(6045), 959–964.

Diaz, A., Eisenberg, N., Valiente, C., Vanschyndel, S., Spinrad, T. L., Berger, R., … Southworth, J. (2017). Relations of positive and negative expressivity and effortful control to kindergarteners' student-teacher relationship, academic engagement, and externalizing problems at school. *Journal of Research in Personality, 67*, 3–14.

Dinan, T. G., & Cryan, J. F. (2015). The impact of gut microbiota on brain and behaviour: Implications for psychiatry. *Current Opinion in Clinical Nutrition and Metabolic Care, 18*(6), 552–558.

Donkers, F. C., & Van Boxtel, G. J. (2004). The N2 in go/no-go tasks reflects conflict monitoring not response inhibition. *Brain and Cognition, 56*(2), 165–176.

Dougherty, L.R. (2006) Children's emotionality and social status: A meta-analytic review. *Social Development, 15*, 394–417.

Drummond, S. P. A., Brown, G. G., Stricker, J. L., Buxton, R. B., Wong, E. C., & Gillin, J. C. (1999). Sleep deprivation-induced reduction in cortical functional response to serial subtraction. *Neuroreport, 10*(18), 3745–3748.

Eisenberg, N., Fabes, R. A., Guthrie, I. K., & Reiser, M. (2000). Dispositional emotionality and regulation: Their role in predicting quality of social functioning. *Journal of Personality and Social Psychology, 78*(1), 136–157.

Eisenberg, N., Fabes, R. A., Nyman, M., Bernzweig, J., & Pinuelas, A. (1994). The relations of emotionality and regulation to children's anger-related reactions. *Child Development, 65*(1), 109–128.

Ellis, H. C., & Ashbrook, P. W. (1988). Resource allocation model of the effects of depressed mood states on memory. In K. Fiedler & J. Forgas (Eds.), *Affect, cognition, and social behavior* (pp. 25–43). Toronto, Canada: Hogrefe.

Else-Quest, N. M., Hyde, J. S., & Hejmadi, A. (2008). Mother and child emotions during mathematics homework. *Mathematical Thinking and Learning, 10*(1), 5–35.

El-Sheikh, M., & Sadeh, A. (2015). Sleep and development: Introduction to the monograph. *Monographs of the Society for Research in Child Development, 80*(1), 1–14.

Engelhardt, L. E., Briley, D. a., Mann, F. D., Harden, K. P., & Tucker-Drob, E. M. (2015). Genes unite executive functions in childhood. *Psychological Science, 26*(8), 1151–1163.

Fagen, J. W., & Prigot, J. A. (1993). Negative affect and infant memory. *Advances in Infancy Research, 8*, 169–216.

Farbiash, T., & Berger, A. (2016). Brain and behavioral inhibitory control of kindergartners facing negative emotions. *Developmental Science, 19*(5), 741–756.

Farmer, A. D., Bierman, K. L., & The conduct problems prevention research group, & conduct problems prevention research group. (2002). Predictors and consequences of aggressive-withdrawn problem profiles in early grade school. *Journal of Clinical Child & Adolescent Psychology, 31*(3), 299–311.

Ferrier, D. E., Bassett, H. H., & Denham, S. A. (2014). Relations between executive function and emotional-

ity in preschoolers: Exploring a transitive cognition and emotion linkage. *Frontiers in Psychology, 5*, 487.

Forgas, J. P. (2001). The affect infusion model (AIM): An integrative theory of mood effects on cognition and judgment. In L. L. Martin & G. L. Clore (Eds.), *Theories of mood and cognition: A user's guidebook* (pp. 99–134). Mahwah, NJ: Erlbaum.

Forgas, J.P. (2008) Affect and Cognition. *Perspectives on Psychological Science, 3,* 94–101.

Forray, A. (2016). Substance use during pregnancy. *F1000Research, 13*(5), 1–9.

Fox, N. A., & Calkins, S. D. (2003). The development of self-control of emotion: Intrinsic and extrinsic influences. *Motivation and Emotion, 27*(1), 7–26.

Fox, N. A., Henderson, H. A., Marshall, P. J., Nichols, K. E., & Ghera, M. M. (2005). Behavioral inhibition: Linking biology and behavior within a developmental framework. *Annual Review of Psychology, 56*, 235–262.

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *The American Psychologist, 56*(3), 218–226.

Fredrickson, B. L. (2004). The broaden–and–build theory of positive emotions. *Philosophical Transactions of the Royal Society of London, Series B: Biological Sciences, 359*(1449), 1367–1377.

Fredrickson, B. L. (2013). Positive emotions broaden and build. In P. Devin & A. Plant (Eds.), *Advances in experimental social psychology* (Vol. 47, pp. 1–53). Burlington, NJ: Academic Press.

Fredrickson, B. L., & Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition & Emotion, 19*(3), 313–332.

Friedman, N. P., Miyake, A., Young, S. E., DeFries, J. C., Corley, R. P., & Hewitt, J. K. (2008). Individual differences in executive functions are almost entirely genetic in origin. *Journal of Experimental Psychology General, 137*(2), 201–225.

Gable, P., & Harmon-Jones, E. (2010). The motivational dimensional model of affect: Implications for breadth of attention, memory, and cognitive categorization. *Cognition and Emotion, 24*(2), 322–337.

Gallagher, M., & Chiba, A. A. (1996). The amygdala and emotion. *Current Opinion in Neurobiology, 6*(2), 221.

Garon, N., Bryson, S. E., & Smith, I. M. (2008). Executive function in preschoolers: A review using an integrative framework. *Psychological Bulletin, 134*(1), 31.

Garon, N., & Moore, C. (2006). Negative affectivity predicts individual differences in decision making for preschoolers. *Journal of Genetic Psychology, 167*(4), 443–462.

Gerardi-Caulton, G. (2000). Sensitivity to spatial conflict and the development of self-regulation in children 24–36 months of age. *Developmental Science, 3*(4), 397–404.

Gerstadt, C. L., Hong, Y. J., & Diamond, A. (1994). The relationship between cognition and action: Performance of children 312–7 years old on a stroop-like day-night test. *Cognition, 53*(2), 129–153.

Giedd, J. (1999). Brain development, IX: Human brain growth. *The American Journal of Psychiatry, 156*(1), 4.

Giedd, J. N., Blumenthal, J., Jeffries, N. O., Castellanos, F. X., Liu, H., Zijdenbos, A., … Rapoport, J. L. (1999). Brain development during childhood and adolescence: A longitudinal MRI study. *Nature Neuroscience, 2*(1), 861–863.

Gogtay, N., Giedd, J. N., Lusk, L., Hayashi, K. M., Greenstein, D., Vaituzis, A. C., … Ungerleider, L. G. (2004). Dynamic mapping of human cortical development during childhood through early adulthood. *Proceedings of the National Academy of Sciences of the United States of America, 101*(21), 8174–8179.

Gray, J. R. (2004). Integration of emotion and cognitive control. *Current Directions in Psychological Science, 13*(2), 46–48.

Greene, T. R., & Noice, H. (1988). Influence of positive affect upon creative thinking and problem solving in children. *Psychological Reports, 63*(3), 895–898.

Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2*(3), 271.

Gross, J. J., & Thompson, R. A. (2007). Emotion regulation: Conceptual foundations. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3–24). New York, NY: Guilford Press.

Gumora, G., & Arsenio, W. F. (2002). Emotionality, emotion regulation, and school performance in middle school children. *Journal of School Psychology, 40*(5), 395–413.

Hajcak, G., & Olvet, D. M. (2008). The persistence of attention to emotion: Brain potentials during and after picture presentation. *Emotion, 8*(2), 250.

Hall, C. M., Welsh, J. A., Bierman, K. L., & Nix, R. (2016). Kindergarten social withdrawal and reading achievement: A cross-lagged path model for at-risk learners. *Psychology in the Schools, 53*(7), 751–759.

Hamre, B. K., & Pianta, R. C. (2001). Early teacher-child relationships and the trajectory of children's school outcomes through eighth grade. *Child Development, 72*(2), 625–638.

Harman, C., Rothbart, M. K., & Posner, M. I. (1997). Distress and attention interactions in early. *Motivation and Emotion, 21*(1), 27.

He, Z.-H., & Yin, W.-G. (2016). Family environments and children's executive function: The mediating role of children's affective state and stress. *The Journal of Genetic Psychology, 177*(5), 143–155.

Henderson, H. A., Pine, D. S., & Fox, N. A. (2015). Behavioral inhibition and developmental risk: A dual-processing perspective. *Neuropsychopharmacology, 40*(1), 207–224.

Hernández, M. M., Eisenberg, N., Valiente, C., Spinrad, T. L., VanSchyndel, S. K., Diaz, A., … Piña, A. A. (2015). Observed emotion frequency versus intensity as predictors of socioemotional maladjustment. *Emotion, 15*(6), 699–704.

Hernández, M. M., Eisenberg, N., Valiente, C., VanSchyndel, S. K., Spinrad, T. L., Silva, K. M., …

Southworth, J. (2016). Emotional expression in school context, social relationships, and academic adjustment in kindergarten. *Emotion, 16*(4), 553–566.

Hofmann, W., Friese, M., Schmeichel, B. J., & Baddeley, A. D. (2011). Working memory and self-regulation. In K. D. Vohs & R. F. Baumeister (Eds.), *Handbook of self-regulation: Research, theory, and applications* (pp. 204–225). New York, NY: The Guilford Press.

Hudson, A., & Jacques, S. (2014). Put on a happy face! Inhibitory control and socioemotional knowledge predict emotion regulation in 5-to 7-year-olds. *Journal of Experimental Child Psychology, 123*, 36–52.

Hughes, K., & Coplan, R. J. (2010). Exploring processes linking shyness and academic achievement in childhood. *School Psychology Quarterly, 25*(4), 213–222.

Ibrahim, O., Sutherland, H. G., Haupt, L. M., & Giffiths, L. R. (2017). An emerging role for epigenetic factors in relation to executive function. *Briefings in Functional Genomics*, Advance online publication. https://doi.org/10.1093/bfgp/elx032

Isen, A. M. (2001). An influence of positive affect on decision making in complex situations: Theoretical issues with practical implications. *Journal of Consumer Psychology, 11*(2), 75–85.

Isen, A. M. (2008). Affect influences decision making and problem solving. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 548–573). New York, NY: Guilford Press.

Isen, A. M., Daubman, K. A., & Nowicki, G. P. (1987). Positive affect facilitates creative problem solving. *Journal of Personality and Social Psychology, 52*(6), 1122–1131.

Izard, C., Stark, K., Trentacosta, C., & Schultz, D. (2008). Beyond emotion regulation: Emotion utilization and adaptive functioning. *Child Development Perspectives, 2*(3), 156–163.

Izard, C. E. (1964). The effects of role-played emotion on affective reactions, intellectual functioning and evaluative ratings of the actress. *Journal of Clinical Psychology, 20*(4), 444–446.

Izard, C. E., Tomkins, S. S., & Vanderbilt University Nashville Tennessee. (1965). In C. D. Spielberger (Ed.), *Affect and behavior: Anxiety as a negative affect in anxiety and behavior*. Cambridge, MA: Academic Press.

Jayawickreme, E., Forgeard, M. J. C., & Seligman, M. E. P. (2012). The engine of well-being. *Review of General Psychology, 16*(4), 327–342.

Johnson, M. H., Posner, M. I., & Rothbart, M. K. (1991). Components of visual orienting in early infancy: Contingency learning, anticipatory looking, and disengaging. *Journal of Cognitive Neuroscience, 3*(4), 335–344.

Jones, N. A., McFall, B. A., & Diego, M. A. (2004). Patterns of brain electrical activity in infants of depressed mothers who breastfeed and bottle feed: The mediating role of infant temperament. *Biological Psychology, 67*, 103–124.

Kagan, J., Reznick, J. S., Clarke, C., Snidman, N., & Garcia-Coll, C. (1984). Behavioral inhibition to the unfamiliar. *Child Development, 55*(6), 2212–2225.

Kannass, K. N., Colombo, J., & Carlson, S. E. (2009). Maternal DHA levels and toddler free-plan attention. *Developmental Neuropsychology, 34*, 159–174.

Karrass, J., & Braungart-Rieker, J. M. (2004). Infant negative emotionality and attachment: Implications for preschool intelligence. *International Journal of Behavioral Development, 28*(3), 221–229.

Keenan, T. (2002). Negative affect predicts performance on an object permanence task. *Developmental Science, 5*(1), 65–71. https://doi.org/10.1111/1467-7687.00210

Keogh, B. K. (2003). *Temperament in the classroom*. Baltimore, MD: Brookes Publishing.

Kieras, J. E., Tobin, R. M., Graziano, W. G., & Rothbart, M. K. (2005). You can't always get what you want: Effortful control and children's responses to undesirable gifts. *Psychological Science, 16*(5), 391–396.

Klapp, A. (2016). The importance of self-regulation and negative emotions for predicting educational outcomes—Evidence from 13-year olds in Swedish compulsory and upper secondary school. *Learning and Individual Differences, 52*, 29–38.

Kochanska, G., Murray, K. T., & Harlan, E. T. (2000). Effortful control in early childhood: Continuity and change, antecedents, and implications for social development. *Developmental Psychology, 36*(2), 220–232.

Kofman, O. (2002). The role of prenatal stress in the etiology of developmental behavioral disorders. *Neuroscience and Biobehavioral Reviews, 26*, 457–470.

Konikowska, K., Regulska-Ilow, B., & Rozanska, D. (2012). The influence of components of diet on the symptoms of ADHD in children. *Roczniki Państwowego Zakładu Higieny, 63*(2), 127–134.

Kopp, C. B. (1982). Antecedents of self-regulation: A developmental perspective. *Developmental Psychology, 18*(2), 199–214.

Kopp, C. B. (1989). Regulation of distress and negative emotions: A developmental view. *Developmental Psychology, 25*(3), 343–354.

Kopp, C. B. (2002). Commentary: The co-developments of attention and emotion regulation. *Infancy, 3*(2), 199–208.

Kopp, C. B., & Neufeld, S. J. (2003). Emotional development during infancy. In R. J. Davidson, K. R. Scherer, & H. H. Goldsmith (Eds.), *Series in affective science. Handbook of affective sciences* (pp. 347–374). New York, NY: Oxford.

Kwon, K., Hanrahan, A. R., & Kupzyk, K. A. (2017). Emotional expressivity and emotion regulation: Relation to academic functioning among elementary school children. *School Psychology Quarterly, 32*(1), 75–88.

Lamm, C., & Lewis, M. D. (2010). Developmental change in the neurophysiological correlates of self-regulation in high- and low-emotion conditions. *Developmental Neuropsychology, 35*(2), 156–176.

Lebel, C., Mattson, S. N., Riley, E. P., Jones, K. L., Adnams, C. M., May, P. A., … Sowell, E. R. (2012). A longitudinal study of the long-term consequences of drinking during pregnancy: Heavy *in utero* alco-

hol exposure disrupts the normal processes of brain development. *The Journal of Neuroscience, 32*(44), 15243–15251.

Lerner, J. V., & Lerner, R. M. (1983). Temperament and adaptation across life: Theoretical and em- pirical issues. In P. B. Baltes & O. G. Brim (Eds.), *Life-span development and behavior* (Vol. 5, pp. 197–231). New York: Academic Press.

Leve, L. D., Neiderhiser, J. M., Shaw, D. S., Ganiban, J., Natsuaki, M. N., & Reiss, D. (2013). The early growth and development study: A prospective adoption study from birth through middle childhood. *Twin Research and Human Genetics, 16*(1), 412–423.

Lévesque, J., Joanette, Y., Mensour, B., Beaudoin, G., Leroux, J. M., Bourgouin, P., & Beauregard, M. (2004). Neural basis of emotional self-regulation in childhood. *Neuroscience, 129*(2), 361–369.

Lewis, A. D., Huebner, E. S., Reschly, A. L., & Valois, R. F. (2009). The incremental validity of positive emotions in predicting school functioning. *Journal of Psychoeducational Assessment, 27*(5), 397–408.

Lewis, M. D. (1993a). Early socioemotional predictors of cognitive competency at 4 years. *Developmental Psychology, 29*(6), 1036–1045.

Lewis, M. D. (1993b). Emotion-cognition interactions in early infant development. *Cognition & Emotion, 7*(2), 145–170.

Lewis, M. D., Lamm, C., Segalowitz, S. J., Stieben, J., & Zelazo, P. D. (2006). Neurophysiological correlates of emotion regulation in children and adolescents. *Journal of Cognitive Neuroscience, 18*(3), 430–443.

Lickliter, R. (2013, November). Communicating developmental psychobiology to nativists. In H.E. Montgomery-Downs (Chair), *Communicating developmental psychobiology. Symposium at the annual meeting of the International Society for Developmental Psychobiology*, San Diego.

Lickliter, R., & Honeycutt, H. (2013). A developmental evolutionary framework for psychology. *Review of General Psychology, 17*, 184–189.

Linnenbrink, E.A. (2007). The role of affect in student learning: A multi-dimensional approach to considering the interaction of affect, motivation, and engagement. In P.A. Schultz & R. Pekrun (Eds.), *Educational psychology series. Emotion in education* (pp. 107–124). San Diego, CA: Elsevier Academic Press.

LoBue, V., & Pérez-Edgar, K. (2014). Sensitivity to social and non-social threats in temperamentally shy children at-risk for anxiety. *Developmental Science, 17*(2), 239–247.

Logue, S. F., & Gould, T. J. (2014). The neural and genetic basis of executive function: Attention, cognitive flexibility, and response inhibition. *Pharmacology, Biochemistry, and Behavior, 123*, 45–54.

Lonigan, C. J., Vasey, M. W., Phillips, B. M., & Hazen, R. A. (2004). Temperament, anxiety, and the processing of threat-relevant stimuli. *Journal of Clinical Child and Adolescent Psychology, 33*(1), 8–20.

Luna, B., Garver, K. E., Urban, T. A., Lazar, N. A., & Sweeney, J. A. (2004). Maturation of cognitive processes from late childhood to adulthood. *Child Development, 75*(5), 1357–1372.

Ly, V., Bottelier, M., Hoekstra, P. J., Vasquez, A. A., Buitelaar, J. K., & Rommelse, N. N. (2017). Elimination diets' efficacy and mechanisms in attention deficit hyperactivity disorder and autism spectrum disorder. *European Child & Adolescent Psychiatry, 26*, 1067–1079.

Martins, E. C., Osório, A., Veríssimo, M., & Martins, C. (2016). Emotion understanding in preschool children: The role of executive functions. *International Journal of Behavioral Development, 40*(1), 1–10.

Maski, K. P., & Kothare, S. V. (2013). Sleep deprivation and neurobehavioral functioning in children. *International Journal of Psychophysiology, 89*, 259–264.

Masters, J. C., Barden, R. C., & Ford, M. E. (1979). Affective states, expressive behavior, and learning in children. *Journal of Personality and Social Psychology, 37*(3), 380–390.

Mayer, E. A. (2011). Gut feelings: The emerging biology of gut-brain communication. *Nature Review Neuroscience, 12*(8), 453–466.

McElhanon, B. O., McCracken, C., Karpen, S., & Sharp, W. G. (2014). Gastrointestinal symptoms in autism spectrum disorder: A meta-analysis. *Pediatrics, 133*(5), 872–883.

McEwen, B. S., & Morrison, J. H. (2013). The brain on stress: Vulnerability and plasticity of the prefrontal cortex over the life course. *Neuron, 79*(1), 16–29.

Mina, T. H., Lahti, M., Drake, A. J., Forbes, S., Denison, F. C., Raikkonen, K., … Reynolds, R. M. (2017). Maternal lipids in pregnancy are associated with increased offspring cortisol reactivity in childhood. *Psychoneuroendocrinology, 83*, 79–83.

Montroy, J. J., Bowles, R. P., Skibbe, L. E., McClelland, M. M., & Morrison, F. J. (2016). The development of self-regulation across early childhood. *Developmental Psychology, 52*(11), 1744–1762.

Morales, S., Taber-Thomas, B. C., & Pérez-Edgar, K. (2017). Patterns of attention to threat across tasks in behaviorally inhibited children at risk for anxiety. *Developmental Science, 20*, e12391.

Moran, T. P. (2016). Anxiety and working memory capacity: A meta-analysis and narrative review. *Psychological Bulletin, 142*(8), 831–864.

Morgane, P. J., Austin-LaFrance, R., Bronzino, J., Tonkiss, J., Diaz-Cintra, S., Cintra, L., … Galler, J. R. (1993). Prenatal malnutrition and development of the brain. *Neuroscience and Biobehavioral Reviews, 17*, 91–128.

Morra, S., Parrella, I., & Camba, R. (2011). The role of working memory in the development of emotion comprehension. *British Journal of Developmental Psychology, 29*(4), 744–764.

Murgatroyd, C., & Spengler, D. (2011). Epigenetics of early childhood development. *Frontiers in Psychiatry, 2*, 16.

Nelson, T. D., Nelson, J. M., Kidwell, K. M., James, T. D., & Espy, K. A. (2015). Preschool sleep problems and

differential associations with specific aspects of executive control in early elementary school. *Developmental Neuropsychology, 40*(3), 167–180.

Nigbur, R., Ivanova, G., & Stürmer, B. (2011). Theta power as a marker for cognitive interference. *Clinical Neurophysiology, 122*(11), 2185–2194.

Nyaradi, A., Li, J., Hickling, S., Foster, J., & Oddy, W. H. (2013). The role of nutrition in children's neurocognitive development, from pregnancy through childhood. *Frontiers in Human Neuroscience, 7*, 97.

O'Mahony, Clarke, Dinan, & Cryan. (2015). Early-life adversity and brain development: Is the microbiome a missing piece of the puzzle? *Neuroscience, 342*, 37–54.

Oakes, L. M. (2009). The "Humpty Dumpty problem" in the study of early cognitive development. *Perspectives on Psychological Science, 4*, 352–358.

Ochsner, K. N., & Gross, J. J. (2005). The cognitive control of emotion. *Trends in Cognitive Sciences, 9*(5), 242–249.

Parvaz, M. A., MacNamara, A., Goldstein, R. Z., & Hajcak, G. (2012). Event-related induced frontal alpha as a marker of lateral prefrontal cortex activation during cognitive reappraisal. *Cognitive, Affective, & Behavioral Neuroscience, 12*(4), 730–740.

Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review, 18*(4), 315–341.

Pekrun, R., Elliot, A. J., & Maier, M. (2006). Achievement goals and discrete achievement emotions: A theoretical model and prospective test. *Journal of Educational Psychology, 98*(3), 583–597.

Pérez-Edgar, K., Bar-Haim, Y., McDermott, J. M., Chronis-Tuscano, A., Pine, D. S., & Fox, N. A. (2010). Attention biases to threat and behavioral inhibition in early childhood shape adolescent social withdrawal. *Emotion, 10*, 349–357.

Phelps, E. A., & LeDoux, J. E. (2005). Contributions of the amygdala to emotion processing: From animal models to human behavior. *Neuron, 48*(2), 175–187.

Piaget, J. (1954). *The construction of reality in the child*. New York, NY: Basic Books.

Piaget, Jean. (1981). *Intelligence and affectivity: Their relationship during child development.* (Trans & Ed T. A. Brown & C. E. Kaegi). Oxford, UK: Annual Reviews.

Posner, M. I., & Raichle, M. E. (1994). *Images of mind*. New York, NY: Scientific American Library/Scientific American Books.

Posner, M. I., & Rothbart, M. K. (1998). Attention, self–regulation and consciousness. *Philosophical Transactions of the Royal Society of London B: Biological Sciences, 353*(1377), 1915–1927.

Posner, M. I., & Rothbart, M. K. (2000). Developing mechanisms of self-regulation. *Development and Psychopathology, 12,* 427–441.

Posner, M. I., & Rothbart, M. K. (2007). Research on attention networks as a model for the integration of psychological science. *Annual Review of Psychology, 58*, 1–23.

Prado, E. L., & Dewey, K. G. (2014). Nutrition and brain development in early life. *Nutrition Reviews, 72*(4), 267–284.

Rader, N., & Hughes, E. (2005). The influence of affective state on the performance of a block design task in 6- and 7-year-old children. *Cognition & Emotion, 19*(1), 143–150.

Raver, C. C. (2004). Placing emotional self-regulation in sociocultural and socioeconomic contexts. *Child Development, 75*(2), 346–353.

Richards, J. M., & Gross, J. J. (2000). Emotion regulation and memory: The cognitive costs of keeping one's cool. *Journal of Personality and Social Psychology, 79*(3), 410–424.

Rieser-Danner, L. A. (2003). Individual differences in infant fearfulness and cognitive performance: A testing, performance, or competence effect? *Genetic, Social, and General Psychology Monographs, 129*(1), 41.

Rothbart, M. K. (2011). *Becoming who we are: Temperament and personality in development*. New York, NY: Guildford.

Rothbart, M. K., & Bates, J. E. (2006). Temperament. In N. Eisenberg, W. Damon, & R. M. Lerner (Eds.), *Handbook of child psychology: Social, emotional, and personality development* (Vol. 3, 6th ed., pp. 99–166). Hoboken, NJ: Wiley.

Rothbart, M. K., & Derryberry, D. (1981). Development of individual differences in temperament. In M. E. Lamb & A. L. Brown (Eds.), *Advances in developmental psychology* (Vol. 1, pp. 37–86). Hillsdale, NJ: Erlbaum.

Rothbart, M. K., & Sheese, B. E. (2007). Temperament and emotion regulation. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 331–350). New York, NY: Guilford Press.

Rothbart, M. K., Sheese, B. E., Rueda, M. R., & Posner, M. I. (2011). Developing mechanisms of self-regulation in early life. *Emotion Review, 3*(2), 207–213.

Rothbart, M. K., Ziaie, H., & O'boyle, C. G. (1992). Self-regulation and emotion in infancy. *New Directions for Child and Adolescent Development, 1992*(55), 7–23.

Rudasill, K. M., & Kalutskaya, I. (2014). Being shy at school. *Sex Roles, 70*(7), 267–273.

Ruff, H. A., & Rothbart, M. K. (1996). *Attention in early development: Themes and variations*. New York, NY: Oxford.

Sadeh, A. (2007). Consequences of sleep loss or sleep disruption in children. *Sleep Medicine Clinics, 2*, 513–520.

Sadeh, A., Gruber, R., & Raviv, A. (2003). The effects of sleep restriction and extension on school-age children: What a difference and hour makes. *Child Development, 74*(2), 444–455.

Sadeh, A., Marcas, G. D., Guri, Y., Berger, A., Tikotsky, L., & Bar-Haim, Y. (2015). Infant sleep predicts

attention regulations and behavior problems at 3-4 years of age. *Developmental Neuropsychology, 40*(3), 122–137.

Sameroff, A. (2010). A unified theory of development: A dialectic integration of nature and nurture. *Child Development, 81*(1), 6–22.

Sawaguchi, T., & Goldman-Rakic, P. S. (1991). D1 dopamine receptors in prefrontal cortex: Involvement in working memory. *Science, 251*(4996), 947–950.

Schelble, J. L., Franks, B. A., & Miller, M. D. (2010). Emotion dysregulation and academic resilience in maltreated children. *Child & Youth Care Forum, 39*, 289–303.

Schmeichel, B. J., Volokhov, R. N., & Demaree, H. A. (2008). Working memory capacity and the self-regulation of emotional expression and experience. *Journal of Personality and Social Psychology, 95*(6), 1526–1540.

Schwarz, N. (1990). Feelings as information: Informational and motivational functions of affective states. In E. T. Higgins & R. Sorrentino (Eds.), *Handbook of motivation and cognition: Foundations of social behavior* (Vol. 2, pp. 527–561). New York, NY: Guilford Press.

Schwarz, N. (2012). Feelings-as-information theory. In P. A. Van Lange, A. W. Kruglanski, & E. T. Higgins (Eds.), *Handbook of theories of social psychology: Volume 1* (Vol. 1, pp. 289–308). London, UK: SAGE Publications Ltd.

Simonds, J., Kieras, J. E., Rueda, M. R., & Rothbart, M. K. (2007). Effortful control, executive attention, and emotional regulation in 7–10-year-old children. *Cognitive Development, 22*(4), 474–488.

Steinberg, L. (2005). Cognitive and affective development in adolescence. *Trends in Cognitive Science, 9*(2), 69–74.

Stifter, C. A., & Braungart, J. M. (1995). The regulation of negative reactivity in infancy: Function and development. *Developmental Psychology, 31*(3), 448–455.

Sudo, N., Chida, Y., Aiba, Y., Sonoda, J., Oyama, N., Yu, X. N., … Koga, Y. (2004). Postnatal microbial colonization programs the hypothalamic-pituitary-adrenal system for stress response in mice. *The Journal of Physiology, 558*, 263–275.

Susa, G., Pitică, I., Benga, O., & Miclea, M. (2012). The self regulatory effect of attentional control in modulating the relationship between attentional biases toward threat and anxiety symptoms in children. *Cognition & Emotion, 26*(6), 1069–1083.

Terwogt, M. M. (1986). Affective states and task performance in naive and prompted children. *European Journal of Psychology of Education, 1*(1), 31–40.

Thompson, B. L., Levitt, P., & Stanwood, G. D. (2009). Prenatal exposure to drugs: Effects on brain development and implications for policy and education. *Nature Review Neuroscience, 10*(4), 303–312.

Thompson, R. A., Virmani, E. A., Waters, S. F., Raikes, H. A., & Meyer, S. (2013). The development of emotion self-regulation: The whole and the sum of the parts. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 5–26). New York, NY: Psychology Press.

Tobi, E. W., Slieker, R. C., Luijk, R., Dekkers, K. F., Stein, A. D., Xu, K. M., … Heijmans, B. T. (2018). DNA methylation as a mediator of the association between prenatal adversity and risk factors for metabolic disease in adulthood. *Science Advances, 4*(1 . Advanced online publication). https://doi.org/10.1126/sciadv.aao4364

Tornare, E., Cuisinier, F., Czajkowski, N., & Pons, F. (2017). Impact of induced joy on literacy in children: Does the nature of the task make a difference? *Cognition & Emotion, 31*(3), 500–510.

Tsujimoto, S. (2008). The prefrontal cortex: Functional neural development during early childhood. *The Neuroscientist, 14*(4), 345–358.

Tsujimoto, S., Yamamoto, T., Kawaguchi, H., Koizumi, H., & Sawaguchi, T. (2004). Prefrontal cortical activation associated with working memory in adults and preschool children: An event-related optical topography study. *Cerebral Cortex, 14*(7), 703–712.

Turnbull, K., Reid, G., & Morton, B. (2013). Behavioral sleep problems and their potential impact on developing executive function in children. *Review of Behavioral Sleep Problems and Development of Executive Function, 36*(7), 1077–1084.

Tzur, G., & Berger, A. (2007). When things look wrong: Theta activity in rule violation. *Neuropsychologia, 45*(13), 3122–3126.

Ursache, A., Blair, C., & Raver, C. C. (2012). The promotion of self-regulation as a means of enhancing school readiness and early achievement in children at risk for school failure. *Child Development Perspectives, 6*, 122–128.

Vaish, A., Grossmann, T., & Woodward, A. (2008). Not all emotions are created equal: The negativity bias in social-emotional development. *Psychological Bulletin, 134*(3), 383–403.

Valiente, C., Lemery, K., & Castro, K. S. (2007). Children's effortful control and academic competence: Mediation through school liking. *Merrill-Palmer Quarterly, 53*(1), 1–25.

Valiente, C., Swanson, J., & Eisenberg, N. (2012). Linking students' emotions and academic achievement: When and why emotions matter. *Child Development Perspectives, 6*(2), 129–135.

Valiente, C., Swanson, J., & Lemery-Chalfant, K. S. (2012). Kindergartners' temperament, classroom engagement, and student-teacher relationship: Moderation by effortful control. *Social Development, 21*(3), 558–576.

van den Bergh, B. R. H., & Marcoen, A. (2004). High antenatal maternal anxiety is related to ADHD symptoms, externalizing problems, and anxiety in 8- and 9-year-olds. *Child Development, 75*(4), 1085–1097.

van Veen, V., & Carter, C. S. (2002). The anterior cingulate as a conflict monitor: fMRI and ERP studies. *Physiology & Behavior, 77*(4), 477–482.

Vogt, B. A., Finch, D. M., & Olson, C. R. (1992). Functional heterogeneity in cingulate cortex: The anterior executive and posterior evaluative regions. *Cerebral Cortex, 2*(6), 435–443.

Vohs, K. K., & Baumeister, R. F. (2004). Understanding self-regulation: An introduction. In *Handbook of self-regulation: Research, theory, and applications* (pp. 1–9). New York, NY: Guilford.

Walker, M. P. (2009). The role of sleep in cognition and emotion. *The Year in Cognitive Neuroscience, 1156*, 168–197.

Walker, S. P., Wachs, T. D., Grantham-McGregor, S., Black, M. M., Nelson, C. A., Huffman, S. L., … Richter, L. (2011). Inequality in early childhood: Risk and protective factors for early child development. *The Lancet, 378*(9799), 1325–1338.

Weber, M., Wagner, L., & Ruch, W. (2016). Positive feelings at school: On the relationships between students' character strengths, school-related affect, and school functioning. *Journal of Happiness Studies, 17*(1), 341–355.

Weinstock, M. (2001). Alterations induced by gestational stress in brain morphology and behavior of the offspring. *Progress in Neurobiology, 65*, 427–451.

Williams, G. V., & Goldman-Rakic, P. S. (1995). Modulation of memory fields by dopamine D1 receptors in prefrontal cortex. *Nature, 376*(6541), 572–575.

Wilson, B. J., & Gottman, J. M. (1996). Attention - the shuttle between emotion and cognition: Risk, resiliency, and physiological bases. In E. M. Hetherington & E. A. Blechman (Eds.), *Family research consortium: Advances in family research. Stress, coping, and resiliency in children and families* (pp. 189–228). Hillsdale, NJ: Lawrence Erlbaum Associates.

Wolfe, C. D., & Bell, M. A. (2004). Working memory and inhibitory control in early childhood: Contributions from physiology, temperament, and language. *Developmental Psychobiology, 44*(1), 68–83.

Wolfe, C. D., & Bell, M. A. (2007). The integration of cognition and emotion during infancy and early childhood: Regulatory processes associated with the development of working memory. *Brain and Cognition, 65*(1), 3–13.

Wolfe, C.D., Zhang, J., Kim-Spoon, J., & Bell, M.A. (2014). Longitudinal perspectives on the association between information processing and temperamental shyness. *International Journal of Behavioral Development, 38*, 266–276.

Yoo, S., Gujar, N., Hu, P., Jolesz, F. A., & Walker, M. (2007). The human emotional brain without sleep – A prefrontal amygdala disconnect. *Current Biology, 17*, R877–R-878.

Zelazo, P., & Cunningham, W. (2007). Executive function: Mechanisms underlying emotion regulation. In J. Gross (Ed.), *Handbook of emotion regulation* (pp. 135–158). New York, NY: Guilford.

Zelazo, P. D., Qu, L., & Kesek, A. C. (2010). Hot executive function: Emotion and the development of cognitive control. In S. D. Calkins & M. A. Bell (Eds.), *Child development at the intersection of emotion and cognition* (pp. 97–111). Washington, DC: American Psychological Association.

Zhou, Q., Chen, S. H., & Main, A. (2012). Commonalities and differences in the research on Children's effortful control and executive function: A call for an integrated model of self-regulation. *Child Development Perspectives, 6*(2), 112–121.

Zhu, P., Sun, M. S., Hao, J. H., Chen, Y. J., Jiang, X. M., Tao, R. X., … Tao, F. (2014). Does prenatal maternal stress impair cognitive development and alter temperament characteristics in toddlers with healthy birth outcomes? *Developmental Medicine & Child Neurology, 56*, 283–289.

Emotion Regulation

Cynthia Stifter and Mairin Augustine

Abstract

The regulation of emotion is essential to adaptive functioning. Whether to hide our disappointment, keep calm, or pump up our excitement, modifying our emotions to achieve our goals is a daily endeavor that in some circumstances and for some individuals requires significant effort. Because the ability to regulate emotions becomes more flexible and improved with age, it is considered a core developmental task with wide-ranging implications and consequences for intrapersonal and interpersonal functioning. In addition, emotion regulation is of scientific interest because it can be examined at multiple levels (e.g., genetic, neurobiological, behavioral, cognitive, social) making it an ideal construct to examine the integration of these levels across development. Despite its developmental significance, emotion regulation continues to have conceptual challenges that enliven the field, while research in emotion regulation has produced exciting and provocative findings. In this chapter, we review the different but overlapping conceptualizations of emotion regulation followed by an examination of its development across the lifespan. We also discuss the different methods for evaluating emotion regulation at different age points. The role of parenting and socialization in the development of emotion regulation and the developmental consequences of emotion regulation are also considered. Finally, we end with a number of recommendations for future research.

Introduction

> Anybody can become angry – that is easy, but to be angry with the right person and to the right degree and at the right time and for the right purpose, and in the right way – that is not within everybody's power and is not easy. –Aristotle

Although emotions and their regulation has been a topic of contemplation since the time of Aristotle, in the past century, a renewed interest in emotions, their development, and implications for adaptation and functioning has emerged. By the early 1990s interest in the functions of emotions as well as advances in measuring and understanding the biological bases of emotion inspired developmental psychologists to reconsider the construct of emotion regulation. Conceptual papers (Campos, Campos, & Barrett, 1989;

C. Stifter (✉)
The Pennsylvania State University, Department of Human Development and Family Studies, University Park, PA, USA
e-mail: tvr@psu.edu

M. Augustine
University of North Carolina at Chapel Hill, Center for Developmental Science, Chapel Hill, NC, USA

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_16

Kopp, 1989), books (Eisenberg & Fabes, 1992), and edited volumes (Fox, 1994; Garber & Dodge, 1991) on the development of emotion regulation marked a turning point of what has now become a firmly established field of study, the results of which have been, and will continue to be, essential to our understanding of human development.

The importance of emotion regulation to human development is intuitively understood and now well established. The ability to modulate your emotions, particularly the reduction of negative emotions, is personally and physiologically "rewarding" (e.g., feels good to not feel bad). Emotion regulation supports social competence and civility by assisting in adherence to societal and cultural rules and standards. Emotion regulation also facilitates other psychological processes by not letting emotions get in the way of their functions. Importantly, emotion regulation is instrumental in attaining intrapersonal, interpersonal, and greater social goals – so that we can feel frustration but not give up, feel apprehensive but still move forward, and feel excited but not so much that we make the wrong decision. Emotion regulation is an important developmental task that has garnered much conceptual and empirical attention in the last 20 years.

In this chapter, we will present the latest in emotion regulation (ER) research including the evolution of the concept, its developmental course, and its measurement. We will also review the most recent research on the socialization of ER as well as its developmental outcomes.

Definition of Emotion Regulation

Although researchers and non-researchers alike intuitively know what emotion regulation is, the translation to actual study has been difficult. Studies either have chosen among an array of definitions or have not explicitly stated the definition that guides them. In some cases, a definition is provided but the measurement of ER does not map onto it. Without a sound, descriptive and generally accepted definition of ER, integration of findings across laboratories would be challenging and reproducibility limited. Consequently, the study of how ER develops across the lifespan, the effectiveness of specific strategies to regulate emotions, and the developmental outcomes of ER cannot move forward.

Due to the burgeoning interest in ER, a conference on the development of ER was convened. The participants addressed such issues as the concept of ER, its physiological correlates, and the interpersonal aspects of ER. The resulting papers were published in the *Monographs of the Society for Research in Child Development* (Fox, 1994) out of which came a working definition of ER from Thompson (1994) which provided an important conceptual and testable base from which future research could progress. Thompson defined ER as consisting of "the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features, to accomplish one's goals" (p. 27–28).

Despite the promise of this definition, a conundrum remained – how to distinguish between level of an emotional reaction and ability to regulate that reaction. For instance, individual children will respond to the same stimulus in different ways; one may respond angrily and take a long time to come to a calm state, while another may show little anger and become quiescent more quickly. Is it fair to say that the first child is unregulated and the second child is well regulated? The second child may have a higher threshold for the stimulus and thus appears more regulated. This question is not easy to resolve without assessing regulation independent of the child's level of emotional arousal along with consideration of several aspects of the child including his or her temperament, goals, environment, and stage of development.

Cole and colleagues (Cole, Martin, & Dennis, 2004) tackled the methodological challenge of separating emotion from its regulation by painstakingly addressing the definitional issues and reviewing the empirical literature (despite its proliferation without an agreed-upon definition). The authors concluded that it was possible to define and thus measure ER as "changes associated with activated emotions." Emotions, particularly in infants and young children, must be

inferred from the child's behavior and the circumstances that elicited this behavior. Cole's definition overlaps with Thompson's (1994) in that change in emotion regulation (ER) can be measured in terms of the valence, intensity, or time course of the activated emotion.

Commentaries in response to Cole's (Cole et al., 2004) article were drawn from several developmental areas and included suggestions that ranged from refining the definition (Bridges, Denham, & Ganiban, 2004; Eisenberg & Spinrad, 2004) to placing ER in social and cultural contexts (Raver, 2004), and incorporating neurophysiological and genetic mechanisms (Bell & Wolfe, 2004; Goldsmith & Davidson, 2004; Lewis & Stieben, 2004). In the concluding commentary to Cole's lead paper, Campos, Frankel, and Camras (2004) proposed a one-factor approach to ER rather than the two-factor approach which assumes an emotion and then a regulatory response (e.g., first you feel angry then you think about something else to distract you from the source of your anger). The one-factor approach proposes emotions and ER as inseparable. Defining emotion by its function of registering the significance of an event and ER as the "modification of any process in the system that generates emotion," Campos proposed that regulation occurs at any level of the emotion generation process including before the activation of an emotion. In addition, because emotions are conceptualized as person-event transactions, regulation is involved in the identification of goals, selection of responses, and the monitoring of the course of the emotion and its movement toward or away from the goal. Recent conceptualizations and empirical evidence from the neuropsychological study of emotion and its regulation note the interconnectedness among the different levels of the neuroanatomical structures, which supports this functionalist approach (Woltering & Lewis, 2009). More recently, Thompson (2011), taking a developmental systems approach, expanded his conceptualization of ER to echo this neurobiological perspective. Thompson argues that the components of emotion, e.g., neurobiological, behavioral, expressive, and experiential, become progressively integrated with development, adapt to contextual demands, and incorporate regulatory processes.

Based on work with adults, Gross (1998) has proposed a model of ER that, in many ways, incorporates the conceptualizations of ER put forward by developmental researchers. Defining ER as activation of a goal to influence the emotion trajectory, this model places ER strategies on a timeline of the progression of emotional response. That is, ER strategies can be differentiated according to the timing of their impact on the emotion generation process which progresses from a psychologically relevant situation to attention and then appraisal of that situation which, in turn, gives rise to changes in experiential, behavioral, and physiological systems that make up an emotion (Gross, 2015). Two categories of ER strategies are proposed: antecedent-focused and response-focused. Antecedent-focused strategies, which include situation selection, situation modification, attentional deployment, and cognitive reappraisal, occur early in the emotion generation stream thereby inhibiting a fully activated emotion. Response-focused strategies (response modification or suppression) occur after the emotion has been evoked. As might be expected, response-focused ER strategies are proposed to occur more frequently at the early end of the lifespan while antecedent-focused strategies emerge and become more efficient later in development. In other words, we would not expect an infant to choose situations to avoid emotion, but as children develop the ability to self-regulate their emotions; such antecedent strategies become a viable option.

Several important principles put forward by these developmental conceptualizations of ER must also be considered (Cole et al., 2004; Gross & Thompson, 2008). (1) Emotions are both regulated and regulating. That is, in addition to requiring regulation, emotions also regulate others, such as when infant distress causes the parent to respond by physically soothing the child. Many studies have examined both forms but the term "emotion regulation" is most often applied to the regulation of emotion. (2) Emotions are neither good nor bad, and the goals of the individual contribute to the emotion elicited and the process of

regulation. Thus, while others may view the child's reactions to a stimulus as dysregulated or inappropriate, for the individual in the moment, and in many cases for the situation (e.g., maltreating parent), it is necessary and adaptive. (3) ER is not limited to decreasing negative emotions. ER includes the maintenance and enhancement of emotions as well. Under some circumstances, negative emotions may be increased in pursuit of a goal such as when a person protests a wrong. Positive emotions can also be regulated in several ways. Positive emotions may need to be down regulated depending on the situation (somber context) or intensity level (child excitement) while in other contexts, the up regulation of positive emotions may be used to initiate and sustain social interaction. (4) Beyond the more proximal contextual demands for emotional behavior, cultural expectations can affect the emotions generated, the choice of regulatory strategy, and when that strategy will be applied in the stream of the emotion generation process.

Taken together, these various positions on defining ER overlap considerably and ultimately agree that the concept is complex, involves multiple systems (genetic, neurophysiological, behavioral, psychological), becomes more integrated with development, and must be considered with regard to the individual's goals and the social and cultural context within which ER develops. Using these principles as a framework to guide research on ER will be critical as we increase our confidence in this construct, and our understanding of the development, measurement, predictors, and outcomes of ER.

Temperament and Emotion Regulation

Individual differences in emotion regulation are often conceived as a part of temperament. Simply defined, temperament is a term applied to individual differences in reactivity and regulation (Rothbart & Derryberry, 1981; Shiner et al., 2012), with one form of reactivity conceptualized as emotional arousal (in addition to attentional and motoric arousal) and temperamental regulation conceptualized as the modulation of reactivity. Thus, it makes sense that individual differences in ER represent temperament, or that temperament underlies these differences. ER, from a temperament perspective, would treat emotion and its regulation as separable but related processes. Indeed, questionnaires that tap temperament in infancy, childhood, and adolescence include dimensions of both emotional reactivity (e.g., anger reactivity, fear reactivity) and regulation. In infancy, items measuring orienting behavior and ease of soothing produce a factor labeled orienting/regulation (Gartstein & Rothbart, 2003). In childhood, effortful control describes the factor derived from dimensions of attention focusing, attention shifting, inhibitory control, and low-intensity pleasure (Rothbart, Ahadi, Hershey, & Fisher, 2001). Rothbart, who discovered these regulatory factors using the questionnaires she developed, went on to define effortful control as the ability to inhibit a dominant response so as to perform a subdominant response, to detect errors, and to plan (Rothbart & Rueda, 2005). This definition is quite similar to that of executive function, which has recently been considered as having a role in ER (see below). A distinction has also been made between whether regulation is voluntary, as in effortful control, or involuntary control that is driven by approach/withdrawal processes (Rothbart & Bates, 2006). This "passive" form of control is focused exclusively on fear-based behavioral control, such as when an inhibited child withdraws from an object/person they perceive as a potential threat. Thus, fear constrains or regulates behavior. Interestingly, passive control is related to later effortful control such that fearful children exhibit better effortful control than fearless children (Kochanska & Knaack, 2003). Another form of involuntary control was put forward that suggested that impulsive approach is a form of "reactive control" such that impulsive children are fueled by their approach system without any voluntary regulation (Eisenberg & Morris, 2002).

There are two important points to emphasize about the regulation concept in temperament: (1) although temperament is considered to be biologically based and thus relatively stable, it

is proposed to develop over time, and (2) individual differences in reactivity are instrumental to the development of regulation. The principle that temperament develops implies that changes in temperamental reactivity are observable and due in part to the emergence and consolidation of regulatory abilities. For example, an angry infant does not always become an angry preschooler; rather, with the development of effective regulatory skills, the child's level of anger reactivity lessens (Stifter, Spinrad, & Braungart-Rieker, 1999). This principle also leaves room for the influence of the environment, most importantly the parenting environment, on the development of regulation (Cipriano & Stifter, 2010; Thompson, 2014).

Temperamental reactivity is instrumental to regulation as it can promote or constrain its development. As emotion is a necessary condition for ER, individual differences in emotional arousal would be expected to affect the developmental course and effectiveness of ER strategies. Several studies illustrate the importance of emotional reactivity to ER. Two studies revealed that extremes in reactivity (intense, unsoothable crying, anger reactivity) related to difficulties in ER longitudinally (Braungart-Rieker & Stifter, 1996; Stifter & Spinrad, 2002). In another study, fear reactivity was found it to be related to poorer effortful control if it increased across infancy (Hill-Soderlund & Braungart-Rieker, 2008). The interaction between reactivity and regulation can also affect later self-regulation. In one study, high levels of anger reactivity combined with high levels of regulation in infancy were predictive of later toddler compliance, a behavior that requires the regulation of both emotion and behavior in young children (Stifter et al., 1999). Similarly, a study examining the interaction fear reactivity and regulation showed high levels of both predicted better 4-year executive function (Ursache, Blair, Stifter, Voegtline, & Family Life Project, 2013). Interestingly, these same infants (high fear/high regulation) had mothers who displayed more positive parenting behaviors. This finding supports the premise that parenting is the most likely process that explains the relationship between temperamental reactivity and the development of regulation as parents are the primary managers of their children's emotions, particularly in the first years of life. If her child is distressed, for example, a mother can physically soothe her infant to reduce the distress. Likewise, if a child is frustrated by having to sit in a high chair, his father can use a toy to distract his son's focus away from the confinement of the high chair toward a more positive stimulus. In both instances, the parent regulates his or her child's observable reactivity but the mode may be dependent upon reactivity type or intensity level (Mirabile, Scaramella, Sohr-Preston, & Robison, 2008). Moreover, the impact of the child's reactivity on the development of self-regulation of emotion may be related to how consistently these strategies are applied by caregivers. Taken together, the results of studies examining the effect of temperamental reactivity on ER indicate that infants with greater emotional reactivity may be at greater risk for regulatory difficulties. However, they may also have more opportunities to practice regulatory behaviors, especially with the support of a responsive parenting environment. The effects of parenting on the development of ER that considers the child's reactivity are discussed below.

Developmental Course of Emotion Regulation Across the Lifespan

Because emotion regulation involves multiple systems, its development is dependent upon changes in each of these systems and the extent to which they become integrated over time. Maturation of neurobiological systems and growth in motor and cognitive processes underlie the development of ER. However, the process is not top-down nor is it intraindividual. Lower level neural activation reflected in emotional reactivity as well as the context within which each of the systems operate can affect the emergence, developmental course, and effectiveness of ER. This is especially relevant in early childhood, which is why most of the research on ER development is conducted with young children.

Moreover, research has focused on the extent to which caregivers play a role in the development of ER and demonstrated that the role changes over time as the child becomes more adept at self-regulating their emotions. Finally, the implications of the ability/inability to regulate emotions are numerous making the development of effective and flexible ER a fundamental developmental task.

Infancy and Toddlerhood

In the first three years of life, significant growth occurs across a number of developmental domains. Rapid changes in motor, emotion, and cognitive processes and their underlying neurophysiology are observed across this period. Paralleling these changes is the development of ER, which is proposed to be governed by development in these domains. This synergy among developmental domains indicates that ER, in turn, influences further developmental progress. For example, by reducing his/her distress an infant can then allocate resources toward attention-focusing and further learning (Blair & Raver, 2015). While advances in cognitive and motor skills are important to the development of ER, the emergence or differentiation of specific emotions can also influence both the development of ER as well as the strategies the infant/toddler employs. In a study of 6-, 12-, and 18-month-olds, Buss and Goldsmith (1998) found that while approach and attention behaviors were effective in reducing anger, only withdrawal was effective in reducing fear. Likewise, the parent-child relationship, specifically attachment, can affect the type of ER strategy use (Calkins & Leerkes, 2004). Securely attached infants were more likely to demonstrate parent-oriented strategies while insecurely attached infants exhibited self-oriented (self-comforting) methods for regulating distress (Braungart & Stifter, 1991; Diener, Mangelsdorf, McHale, & Frosch, 2002).

Though the regulation of emotions in early childhood is primarily dependent upon the caregiving environment (see below), even the youngest infant has some innate mechanisms for reducing their emotional arousal. These behaviors may be initially effective, but they are difficult to sustain without the input of parents and other caregivers. Reflexive behaviors such as gaze aversion and turning the head are two examples of behaviors that can effectively reduce distress and avoid stimuli that evoke it (Kopp, 1989). As reflexes are replaced with voluntary motor behaviors such as grasping and attention, the infant has at his/her disposal abilities to navigate the environment, although in a limited fashion, by reaching and exploring toys to enhance emotions or keep them at bay by shifting attention away from mildly aversive stimuli (Kopp, 2002). Voluntary gaze aversion and head turning were observed during positive mother-infant interactions (Stifter & Moyer, 1991), and the results showed these behaviors were more likely to occur at peak intensity of positive affect. This brief break appeared to allow the infant to reduce arousal and rejoin the interaction. Self-comforting behaviors such as thumb sucking, body stroking, etc. are rudimentary forms of ER that have also been observed in early infancy (Rothbart, Ziaie, & O'Boyle, 1992; Stifter & Braungart, 1995) to effectively reduce negative emotionality.

With increased attention control and locomotor behaviors in the second half of the first year, infants are able to physically approach stimuli for the purposes of increasing positive emotion, and inhibit approach when stimuli are novel or uncertain (Kopp, 1989). In the same situation, older infants may make use of their burgeoning social referencing skills to gather information from a trusted caregiver to aid in the ER process (Walden & Ogan, 1988). The increased use of nonnegative vocalizations and gestures to communicate the infants' needs, rather than crying, can postpone emotional reactivity. Responsive caregivers who act on the infants' behalf by removing the source of negative affect or bring them into closer contact to enhance positive affect can help infants to regulate their emotions while reinforcing the use of such communicative acts (Papousek, 2007).

In toddlerhood, motor behavior becomes more organized and fluid allowing the child greater

opportunities for emotional experiences, which in turn may require ER. Along with increased motor skills are two developmental milestones that emerge during the toddler years that support further ER development: language and self-awareness. With improved language, toddlers are able to be more specific about their needs by using words rather than emotions (Cole, Armstrong, & Pemberton, 2010). There is very little research on the role of language in the development of ER; however, one study showed that increased language skills paralleled decreases in anger (Roben, Cole, & Armstrong, 2013). A positive relation between language skills and distraction suggests that language may postpone the need for other ER strategies. The increasing use of language to communicate toddlers' needs with parents may also lead to conversations about emotions and their causes and consequences. These interactions may encourage parents to introduce rules about emotion expression and strategies for the purposes of regulating emotions.

One cognitive advancement that influences ER development during the second year of life is an emerging self-awareness. The sense of self as object and agent helps the toddler to "own" their emotions and think of ways to alter circumstances to either maintain an emotion or change it (Kopp, 1989). Self-awareness, particularly with regard to one's own emotions, therefore, may be conceived as the first step in the development of emotion self-regulation. Although there is no research on the role of self-awareness and ER in young children, the work on self-evaluative emotions suggest that 2- to 3-year-olds are increasingly aware of how they are perceived and evaluated (Lewis, 2000).

Childhood and Adolescence

The development of ER continues through childhood into adolescence with some of the greatest growth occurring during the preschool years. The ability to self-regulate emotions becomes easier and more sustained, and in many cases internalized. The types of ER strategies children use also change with age from more emotion-focused strategies to cognitive ER strategies such as reappraisal. External regulation changes accordingly, with caregivers providing support through the communication of social standards and rules as well as conveying more sophisticated methods for self-regulation (Thompson & Meyer, 2007). Moreover, as the number and complexity of social groups grow so too do the demands for advanced emotion understanding and ER.

As the child proceeds through the preschool and middle childhood years, the role of caregivers begins to take a backseat to the child's emerging self-regulation of emotion. Caregivers continue to have an influence on ER development through instruction, modeling, and interpretation of emotional events, which are generally applied to match the child's level of understanding during childhood (Morris, Silk, Steinberg, Myers, & Robinson, 2007). Very little research has considered parenting of adolescent ER. There is some evidence that parental warmth is related to better ER in adolescents (Eisenberg et al., 2005; Walton & Flouri, 2010) but as these studies were not longitudinal it is not clear whether warmth during adolescence was critical or whether it was important across childhood.

One cognitive process proposed to support ER is executive function, or the conscious control of thought and action needed for future-oriented and purposeful behavior (Welsh, Friedman, & Spieker, 2006). Comprising the abilities of attention regulation, inhibitory control, working memory, error detection, and planfulness, executive function develops rapidly through the preschool years but continues to mature through adolescence (Best & Miller, 2010). With development, the effectiveness of these skills increases and they begin to work together to solve more complex problems with greater processing efficiency. Importantly, the development of executive function parallels the maturation of the prefrontal cortex through continued myelination and synaptic pruning (O'Hare, Sowell, Nelson, & Luciana, 2008). Recently, researchers have begun to develop models integrating the emergence of executive function and the development of ER (Zelazo & Cunningham, 2007). For example, two studies have shown inhibitory control to be

related to ER (Carlson & Wang, 2007; Hudson & Jacques, 2014).

Each of the components of executive function can operate to support ER. For example, regulation of attention can remove the child from an emotionally arousing stimulus without having to physically move away. One study tracking the use of attention shifting and anger reactivity during a frustration task from 18 months to 4 years of age found that developmental changes in attention predicted age-related changes in the latency to become angry (Cole et al., 2011). Improvements in working memory assist the child in recalling what strategies work and how to sustain them in the face of arousing stimuli, and planning can be used to avoid situations that the child knows are likely to elicit high levels of emotion (e.g., situation selection, Gross & Thompson, 2008). The ability to inhibit a dominant response and produce a subdominant response is especially relevant to ER. For example, a child with good inhibitory control who knows that she should not express anger when asked to stop playing, can inhibit that emotional response and substitute the more appropriate response of putting the toys away (Kochanska & Knaack, 2003). Indeed, that example scenario involves a number of executive functions as well as emotion understanding, skills that are readily available and employed for more seamless ER.

Understanding one's emotions and how to control them is related to successful ER. Emotion understanding, which includes the ability to label emotions, use emotion language, understand the causes and consequences of emotions, and recognize that others can experience emotions that are different from one's own, develops across the lifespan but shows significant gains during the preschool period (Denham, 1998). As preschoolers become aware of how emotions can be changed, for good or bad, then children can make informed choices about when and how to self-regulate their own emotions. In support of this proposal are studies showing that emotion situation knowledge (Garner & Power, 1996) and ER strategy generation (Cole, Dennis, Smith-Simon, & Cohen, 2009) are related to young children's own effective ER behaviors. Another form of emotion understanding is the knowledge and use of display rules. Display rules are social conventions for when and how to express our feelings. Because display rules require a number of developmental skills such as perspective-taking and memory, success in adhering to a social rule gets better with age. Display rule understanding, assessed with hypothetical situations, improves steadily across the preschool/middle childhood period leveling off at about 11 years of age (Gnepp & Hess, 1986). However, when children are observed during a situation that calls for display rule use, such as maintaining a smile/neutral expression when given an unwanted gift, children as young as 3 years show emergent abilities to control their emotion expressions in social situations (Cole, 1986). Not surprisingly, girls tend to be better at this form of ER than boys (Cole, 1986; Simonds, Kieras, Rueda, & Rothbart, 2007).

Although entering adolescence is characterized by improved ER abilities, due to the widening of social and interpersonal expectations as well as significant hormonal changes accompanying puberty, adolescence has been marked as a period of heightened emotional reactivity (L. Steinberg & Morris, 2001). Recent advances in neuroscience have found significant periods of change in brain regions associated with response inhibition suggesting that the "storm and stress" observed during the second decade of life is due to the inability of the adolescent to fully master control of his or her emotions (L. Steinberg, 2005). Studies of ER in adolescence are not as plentiful as studies in early childhood but the findings reveal ER development to continue, much of it focused on cognitive strategies. Studies of reappraisal have shown increases in this strategy for regulating emotions across adolescence (Silvers et al., 2012) and decreases in emotion suppression (Gullone, Hughes, King, & Tonge, 2010). As expected, male adolescents were more likely to use suppression than female adolescents were (Gresham & Gullone, 2012; Gullone et al., 2010).

Adulthood and Aging

One might expect that reaching adulthood would signal the pinnacle in ER development. However, changes are noted across adulthood and into the later years of life. Few studies have taken a life span perspective but one such study found increases in adaptive ER (cognitive ER) from adolescence into emerging adulthood and adulthood (Zimmermann & Iwanski, 2014).

Despite the decline in physiological functioning that characterizes old age, the assumption that control of negative emotion and general positivity would exhibit a similar downward trajectory has not been proven. Rather, several studies have shown the older adults to experience less frequent negative emotions while maintaining high levels of positivity (Carstensen, Pasupathi, Mayr, & Nesselroade, 2000). Older adults have also been found to move more quickly out of negative states than younger adults (Carstensen et al., 2000; Hay & Diehl, 2011) most likely because they tend to use passive forms of ER (e.g., suppression, denial) rather than facing their emotions head-on (Blanchard-Fields, Stein, & Watson, 2004). Based on these findings, Cartensen (Carstensen, Fung, & Charles, 2003) conceived the socioemotional selectivity theory, which posits that the time limits perceived by older adults motivate them to focus on emotionally relevant goals such as interpersonal relationships. Older adults selectively reduce their social groups, attend to and recall the positive aspects of life, and control their negative emotions for the purposes of maximizing the emotional payoff. Older adults may also understand that positive emotions can counter or "undo" negative emotions. The recent positive psychology movement has generated much interest in the function of positive emotions including their relation to ER. Fredrickson (2001) proposed the Broadening and Building Hypothesis of Positive Emotions which states that positive emotions including happiness, interest, and love, broaden one's thoughts and actions as well as build resources for future needs such as coping with adverse events. Another function of positive emotions is the undoing of negative emotions. Studies have shown positive emotions to alter both physiological and psychological effects associated with negative emotions (Fredrickson, Mancuso, Branigan, & Tugade, 2000; Tugade & Fredrickson, 2004).

The Measurement of Emotion Regulation

In order to understand the developmental course of emotion regulation and its relation to biological, social, and emotional functioning, we must be able to measure it. Moreover, since ER changes over time, both in quality and competency, methods for assessment must necessarily take into account the developmental level of the individual. Additionally, even though ER may be observable in some cases, much of the regulatory process is internalized, a process that is also dependent, in part, upon the age and ability of the individual (Adrian, Zeman, & Veits, 2011). Lastly, measurement logically follows conceptualization and operationalization. Given the diversity of theoretical approaches to, and definitions of, ER and the consequential difficulty in integrating research findings, it is no surprise that there are parallel methodological challenges. These issues have been discussed in special sections (e.g., Suveg & Zeman, 2011) and papers (Cole et al., 2004). Here we briefly review the different methods that are used to assess ER across development.

The methods that are typically used to assess ER can be categorized into four types: self-report, other report, observational, and psychophysiological (Adrian et al., 2011). As expected, age is related to type of method with infants, toddlers, and preschoolers' ER assessed predominantly by observational studies or other report, whereas the primary mode of assessing adolescent ER is through self-report.

In infancy and toddlerhood, observations of emotional reactivity and the behaviors exhibited during an emotion-eliciting task are necessary to assess the regulation of emotion. Tasks that elicit anger, fear, and general distress are most often used to measure ER that is either self-initiated or initiated within a caregiver interaction. Typically,

tasks such as arm restraint and toy removal/barrier have been used to elicit anger while mechanical spiders and novel toys/persons have been used to elicit fear (Buss & Goldsmith, 1998; Crockenberg & Leerkes, 2004; Stifter & Braungart, 1995). Studies that have examined caregiver regulation of infant general distress use semi-naturalistic settings such as an immunization procedure or the still-face procedure (Braungart-Rieker et al., 2014; Jahromi, Putnam, & Stifter, 2004).

By preschool age, children are developing an understanding of emotions, can talk about their own emotions, and can discuss how they might regulate them; the reliability of their self-reports, however, is questionable. Alternatively, reports by caregivers on infants, toddlers, and preschoolers provide an easy and efficient way to assess ER. The temperament questionnaires developed by Rothbart (e.g., Child Behavior Questionnaire Rothbart et al., 2001) assess regulatory behaviors (attention, effortful control), as well as the child's emotionality. Also available are questionnaires specific to ER which either ask caregivers to rate the target child's ER ability (Shields & Cicchetti, 1997) or provide emotion scenarios to which the caregiver reports on the child's ER strategies (Fabes, Poulin, Eisenberg, & Madden-Derdich, 2002).

As preschoolers are better able to internalize the regulatory process than younger children are, the challenge for observers is whether an emotion has been activated. Thus, researchers have had to develop creative ways of measuring ER. The disappointment paradigm (Cole, 1986) creates a situation in which the child expects to receive a desired gift (reward for doing another task) but receives their least favored toy. The experimenter gives the child the less desired "gift" and remains in the room while the child unwraps it creating a social situation in which display rules would be required. Other tasks, some designed for other purposes, have been used to assess ER in preschoolers such as delay tasks (e.g., gift delay; Kochanska & Knaack, 2003), mood induction (Cole, Zahn-Waxler, Fox, Usher, & Welsh, 1996), and stranger interactions (Bishop, Spence, & McDonald, 2003).

Few studies on ER in elementary school-aged children and adolescents have used observational measures, and those that do use such methods as emotion induction, peer rejection, and parent-child interactions (see Adrian et al., 2011 for a full list). Rather, self-reports of child/adolescent emotions and strategies to modulate those emotions are more widely used. Questionnaires, diaries, and more recently ecological momentary assessments (EMAs) vary in the specificity of the amount, effectiveness, and time course of the ER process assessed. EMAs are an especially promising method for assessing ER, as they ask the individual to report on their emotional experiences in the present moment over a range of time. Data are collected by cell phones, have been used by children aged 7–18 (Heron, Everhart, McHale, & Smyth, 2017), and are capable of capturing emotion dynamics in everyday life including ER strategies used in response to specific emotions (e.g., Tan et al., 2012).

Physiological measures also have been measured in relation to ER. Here the hypothesis is that the development and function of these systems form the foundation for behavior, including the ability to regulate emotions. As such, most studies have examined the relationship between neurological, hormonal, or autonomic indices and behavioral measures of ER or in some cases have used the physiological measures as a proxy for ER. Cardiac activity, particularly changes in parasympathetic input to the heart (as measured by respiratory sinus arrhythmia), has been used to reflect a self-regulating biological system underlying ER (Porges, 2003). Importantly, this system is easily measured even in the youngest children. See Zisner and Beauchaine (2016) for a description of several psychophysiological methods appropriate for children. Other methods easily employed with young children but less researched in relation to ER include neuroendocrine responses (e.g., cortisol, Gunnar & Quevedo, 2007) and genetic factors (Kochanska, Philibert, & Barry, 2009).

Assessing neural activity related to ER had been limited to EEG lateralization studies, which at the time were successful in demonstrating differences with regard to approach/

withdrawal behaviors in young children. With the development of more advanced technologies that read specific electrical signals from the brain (evoked response potentials) or image the brain, research on the neural indices of ER have advanced rapidly and continue to chart new territory. Comprehensive reviews on the neural bases of ER can be found in Davidson, Fox, and Kalin (2007), Dennis (2010), and Morales & Fox, Chap. 4).

Each of the methods for assessing ER in young children and adolescents reviewed above have their limitations. While observational methods are essential to understanding the emotion regulatory process, they are just snapshots of the child's abilities. Reports of children's ER by caregivers expands the assessment of ER over different contexts and situations but suffers from reporter bias (Stifter, Willoughby, & Towe-Goodman, 2008). Indeed, research has shown parent ratings to reflect more of the parent personality and mood than the characteristics of the child (Parade & Leerkes, 2008). Self-reports are an excellent way to assess ER processes that are internalized and more difficult to elicit in the lab when respondents are old enough to do so. However, they are limited to ages at which children can reflect and report accurately on their own emotions. Self-reports also require compliance which may be difficult with adolescents. Newer methodologies that include the use of cell phones or other electronic devices may be more attractive to older children and adolescents. More importantly, EMAs can record the child's emotions and regulatory process in the moment, which are comparable to ER measured in the lab. And, while the context of the ER process can be captured by this method, something that cannot be done in the lab, the daily lives of the respondents are likely to involve fewer or less-intense emotions than those elicited by laboratory tasks (Heron et al., 2017). Lastly, psychophysiological measures are inherently difficult to obtain, especially with younger children, which has implications for the characteristics of the sample (willing participants may be more adept at regulating their emotions). Missing data should be expected with this age group. Moreover, the relationship between neurophysiological measures and other ER measures are not very robust and oft-times nonsignificant. This is particularly problematic when the measure is used as a substitute for ER. In summary, as with other psychological constructs the measurement of ER faces several issues including that the various methods do not correlate highly with each other. As ER is a complex, multifaceted construct, a component of variance approach might be best when designing a study on ER. Multiple assessments considered to reflect the different components of ER should be obtained. Researchers may then examine relations between different ER assessments and the extent to which these assessments account for shared and/or unique variance in relevant developmental outcomes. Additionally, latent variable modeling may allow researchers to examine whether differing ER measures appear to emerge from a single common factor, or separable factors each with particular common characteristics, with relations to other variables of interest. This sort of approach has been used to examine commonalities between putative measures of effortful control and executive function (Bridgett, Oddi, Laake, Murdock, & Bachmann, 2013).

Parenting, Socialization, and Emotion Regulation

Beyond normative developmental change in regulatory capacities, it is clear that early experiences also contribute to the development of emotion regulation. Specifically, parenting and socialization experiences may serve to support or undermine ER in infants and children. In the following section, we review a selected set of major socialization constructs highlighted in the literature on ER, including parent-child relationship qualities and characteristics of the parent and family context.

A crucial process for the regulation of emotion during early parent-infant interactions is the co-regulation of infant distress. Due to the more vulnerable nature of infants and toddlers, caregivers assist in the management of emotional arousal through behaviors that contingently and

appropriately soothe, comfort, or distract from salient stimuli (e.g., Crockenberg & Leerkes, 2004; Jahromi et al., 2004; Jahromi & Stifter, 2007). In our own lab, we have shown that parents' use of holding, rocking, and vocalizing either alone or together is an effective means of reducing crying in response to immunization (Jahromi et al., 2004; Stifter & Rovine, 2015). Likewise, studies of maternal touch have shown its regulating effects on infant emotion (Stack & Jean, 2011) and accompanying physiological reactivity (Feldman, Singer, & Zagoory, 2010). Crockenberg and Leerkes (2004) found patterns of mother-infant interaction that illustrate how the mother and child worked together to manage infant distress following an exposure to a novel toy. Mothers directed their infants' attention away from the novel toy and responded contingently to their infants' looking away behavior, resulting in reduced infant distress. This same form of contingency which supports future self-regulation of emotion was found in toddlers (Putnam, Spritz, & Stifter, 2002). For this reason, caregiver sensitivity and responsiveness to distress are found to be correlated with measures of children's self-regulation of emotion (Davidov & Grusec, 2006; Leerkes, Nayena Blankson, & O'Brien, 2009).

Children's attachment security has also been identified as a correlate of their ER strategies. One reason for this is that parents' tendency to respond quickly and sensitively to their infants' distress, a predictor of attachment security, also reflects a readiness to help infants successfully manage emotional arousal and thus encourage their development of self-regulation of emotion (Ainsworth, Bell, & Stayton, 1974). Another reason proposed by Cassidy (1994) is that children's attachment style involves representations of their caregiver's availability and willingness to respond to distress, which may in turn lead to varying patterns of emotional modulation and expression. Securely attached infants and children may rely on their caregivers' responsiveness during times of distress and feel comfortable using the caregiver as a coregulatory support. Infants, who form an insecure-resistant/ambivalent attachment style, resulting from inconsistent caregiver responsiveness to infant cues, may upregulate negative emotional displays in order to better recruit caregiver attention and responses. Infants, who form an insecure-avoidant attachment style, resulting from the caregiver's consistent rejection or nonresponse to infant attachment cues, may come to minimize visible emotional displays even while experiencing physiological arousal. Although adaptive in the context of the parent-child relationship, both of these latter strategies may be viewed as dysregulated, rather than competent, emotional responses in other social settings. Studies examining relations between attachment security and children's ER provide some support for this idea, such that children with a resistant attachment tend to be identified with more regulatory difficulties, whereas those with an avoidant attachment tend to use more self-focused or nonsocial regulatory strategies (Zimmer-Gembeck et al., 2017). And, in middle childhood, greater security of attachment was associated with their ratings of aggression as a less effective strategy for managing anger-eliciting situations with parents and peers, and problem-solving as more effective (Waters & Thompson, 2016). Cassidy and colleagues have also recently emphasized the value of studying ER as a mediator between attachment security and different forms of psychopathology (Cassidy, Jones, & Shaver, 2013).

Emotion regulation development during the infancy and toddler periods is paralleled by a decrease in parent intervention, but parents continue to have an influence on later emotion self-regulation (Spinrad, Stifter, Donelan-McCall, & Turner, 2004). In particular, as progress in cognitive and motor development supports greater autonomy in emotional and behavioral responses and greater memory for previous social interactions, socialization processes convey parents' expectations for children's emotional responses and emotional expressions, and provide children with many strategies to utilize in the service of emotional self-regulation (Fox & Calkins, 2003; Kopp, 1982). The conceptual framing of parental control and its expected outcomes varies widely across researchers (see Grusec, 2011). However, with regard to the prediction of adaptive out-

comes like ER, emphasis has been placed on parenting behaviors reflecting gentle discipline, support, or feedback that provide structure and communicate expectations to the child while also supporting the child's autonomy to enact responses (e.g., Baumrind, 2013; Grolnick & Pomerantz, 2009; Grusec, 2011; Kochanska & Aksan, 1995). Specific to the development of ER, parental control behaviors may convey information about appropriate emotional responses and methods to achieve them, and allow for practice and skill development over time, while avoiding harsh or power assertive techniques reflecting the expectation of competent child emotional responses at all costs.

Much of the research on parental control and ER focuses on how parental behavior relates to children's emotional responses to challenging tasks. This work suggests that mothers' gentle discipline behaviors relate to less negative or defiant responses in situations where children are asked to inhibit or produce particular behaviors (Kochanska & Aksan, 1995). Additionally, mothers' tendency to facilitate children's management of disappointment or frustration by encouraging the child to redirect attention, reframe their thoughts about the experience, or engage in planning relates to greater understanding of regulatory strategies for managing anger and less expression of anger and sadness during emotionally evocative tasks (Cole et al., 2009; Morris et al., 2011).

Parents' overall style of structuring their children's emotional experiences also has implications for the development of ER. In general, children appear to develop better ER and emotional coping skills when parents feel comfortable discussing emotional experiences with their children and react supportively to their children's expression of emotion, particularly negative emotion (Eisenberg, Cumberland, & Spinrad, 1998; Morris et al., 2007; Thompson, 2014). These responses address, rather than exacerbate, children's emotional arousal, and encourage children to actively manage emotions and apply regulatory strategies in lieu of emotional dysregulation or avoidance.

Another popular construct in the realm of emotion socialization styles is parents' meta-emotion philosophy (Gottman, Katz, & Hooven, 1996). Meta-emotion philosophy can be understood as a set of thoughts and feelings parents have about their emotions and their children's emotions that guides their style of socializing their child's management of emotional experiences. In their early work, Gottman and colleagues identified an emotion-coaching philosophy in which parents are aware and validating of emotions in the self/child, encourage the child to identify their emotions, and help the child to problem-solve about emotions through limit-setting or discussion about emotional goals or strategies (Gottman et al., 1996; Morris et al., 2007). This is contrasted with an emotion-dismissing philosophy in which parents tend to experience discomfort with emotional expression and discourage discussion about emotions. Subsequent research has found that various measures of emotion-coaching quality, including validation and acceptance of children's emotions, tends to relate to better ER in children and adolescents, whereas emotion-dismissing qualities have opposite relations (Gottman et al., 1996; Katz, Maliken, & Stettler, 2012).

Children's ER has also been predicted by other forms of relational or affective positivity in the parent-child relationship, such as parents' expression of positive emotion, warmth, responsiveness to emotional cues, and sensitivity during normal interactions (Bariola, Gullone, & Hughes, 2011; Halligan et al., 2013; Morris et al., 2007; NICHD Early Child Care Research Network, 2004). Recent findings suggest that these positive qualities may support observable manifestations of children's ER by supporting more adaptive physiological responses. Specifically, maternal sensitivity, emotional support, and positive relationship quality relate to greater vagal withdrawal in response to emotionally evocative stimuli from infancy through childhood, with indirect paths to ER strategy use in infancy (Calkins, Graziano, Berdan, Keane, & Degnan, 2008; Perry et al., 2013; Perry, Calkins, & Bell, 2016).

However, studies also commonly observe links between negative qualities of the parent-child relationship and poorer child ER at the observed and physiological level. This body of

research has examined a range of measures including harsh and inconsistent discipline, corporal punishment, directive/critical parenting, and negatively controlling interactions (Calkins, Smith, Gill, & Johnson, 1998; Chang, Schwartz, Dodge, & McBride-Chang, 2003; Duncombe, Havighurst, Holland, & Frankling, 2012; Mathis & Bierman, 2015; Morris et al., 2007). Negative or harsh parenting behaviors are believed to undermine the development of child ER by exacerbating children's negative arousal, providing children with fewer effective models and strategies for constructive emotion regulation, and/or encouraging maladaptive patterns of emotional dysregulation or suppression. Further, there is some evidence that negative parenting qualities are a stronger predictor of children's ER than positive parenting qualities (e.g., Calkins et al., 1998; Mathis & Bierman, 2015). Nonetheless, it is important to note that parents' negative emotional expression has equivocal links to children's ER, with some studies finding null or positive links to ER (Bariola et al., 2011; Moed, Dix, Anderson, & Greene, 2017). This could be because a moderate level of negative emotion expression reflects parents' acceptance, rather than suppression, of negative emotional experiences, allows parents to model strategies for managing negative emotional experiences and, at times, more effectively conveys dissatisfaction with child responses. Conversely, rapid increases in parent negative emotion in response to aversive child behavior may have a uniquely adverse influence on children's ER (Moed et al., 2017).

Parents' own emotional characteristics may also serve a socializing function in the development of the child's ER. The emotional climate of the family has been highlighted as a predictor of children's expectations about what emotions are acceptable to display or what overall level of emotional reaction is appropriate in the family and in turn the social world (Eisenberg et al., 1998). Some research has linked positive emotional expressiveness in the family specifically to aspects of ER in the child; however, it is acknowledged that positive and negative expressiveness in the family may be correlated with other more proximal qualities of the parent-child relationship (Morris et al., 2007). Similarly, although parents may serve as salient models of ER and (mal)adaptive patterns of emotional responding within their children's regulatory development, few studies have specifically examined parental ER as a predictor of child ER (Bariola et al., 2011; Morris et al., 2007). However, at least two recent studies have found significant relations between mothers' self-reported emotional dysregulation and difficulty with awareness and regulation of emotion, and poorer concurrent ER in their children (Crespo, Trentacosta, Aikins, & Wargo-Aikins, 2017; Morelen, Shaffer, & Suveg, 2016). Additionally, mothers' self-report of more positive mental representations about their own emotions and ER have been found to relate to more positive ER strategies in the child, mediated by mothers' use of positive emotion socialization practices (Meyer, Raikes, Virmani, Waters, & Thompson, 2014).

Related to the above, a host of other parental factors may indirectly contribute to the overall positive or negative emotional climate of the family and parenting relationship, with consequences for children's ER. For example, poor parental marital quality and conflict between parents and other family members is consistently implicated for its role in children's emerging emotion dysregulation, due its detrimental effects on children's sense of emotional security in the family (Cummings & Davies, 1994; Cummings & Schatz, 2012; Morris et al., 2007). Children who experience lower felt emotional security resulting from exposure to frequent and destructive family conflict, and less-positive parenting qualities typically displayed by parents embroiled in these interactions, are found to develop greater distress to negative stimuli as well as maladjustment in many emotional, cognitive, and physiological characteristics necessary for competent ER. Parental psychopathology is also a correlate of poorer ER skills in their children. Although the mechanisms for these effects have not yet been clearly elucidated, greater symptom severity likely challenges parents' ability to be sensitive, positive, and well regulated during parent-child interactions; this negative parenting environment may influence child ER both directly and by exacerbating emotion-relevant genetic vulnerabilities passed from parent to child (Calkins &

Dollar, 2014; Morris et al., 2007; Suveg, Shaffer, Morelen, & Thomassin, 2011).

Researchers also consistently recognize the role of child characteristics in child regulatory development, including moderating influences of child temperamental reactivity as well as potential bidirectional relationships between parenting and child regulation (e.g., Kiff, Lengua, & Zalewski, 2011). Research to date on temperament-by-parenting interactions tends to focus on regulatory capacities as a moderator of relations between parenting and other developmental outcomes (e.g., behavior problems; see next section) rather than as an outcome. In one study, however, parental behaviors such as warmth and approach interacted with child temperamental approach to predict better ER in preschoolers (Dennis, 2006). There is also evidence that parenting relates to indicators of temperamental regulation (e.g., effortful control) based on the characteristics of the child. For example, Kochanska and colleagues have found that positive aspects of the mother-child relationship related to measures of effortful control in children lower in fearfulness, higher in anger-proneness, or higher in overall negative emotionality (Kim & Kochanska, 2012; Kochanska, Aksan, & Carlson, 2005; Kochanska, Aksan, & Joy, 2007). Examining temperament groups created based on affect and approach-withdrawal responses to novelty, a study from our lab (Cipriano & Stifter, 2010) found that mothers' use of positive-tone commands/prohibitives during a frustrating wait task related to greater later effortful control only for children classified as temperamentally exuberant. Although these studies do not assess the interactive process, the findings suggest that parent behavior is influenced by the temperament of their children, which has consequences for the development of regulatory capacity.

Developmental Outcomes of Emotion Regulation

Emotion regulation is associated with many outcomes thought to reflect positive adjustment in childhood and adolescence. In this section, we highlight a number of such outcomes in the developmental literature, including the adaptive outcomes of greater ER and maladaptive outcomes of poorer ER.

First, ER relates to qualities reflecting competent and other-oriented social responses. Measures of ER relate to social and peer adaptation, including measures of socially appropriate behavior, school adjustment, social competence, peer acceptance, and popularity (Blair et al., 2015; Calkins & Keane, 2004; Denham, Bassett, Sirotkim, & Zinsser, 2013; Denham et al., 2003; Spinrad et al., 2006). Many of these connections appear to be based in children's regulation of negative emotions, particularly anger and sadness. Children's social environments regularly involve challenging demands, such as the need to end a desirable behavior and enact another (e.g., teacher asks child to stop playing with toys and put them away), to cooperate and take turns with others, or to accept a situation counter to one's personal desires (e.g., peers choose to play child's least favorite game). Emotion regulation skills allow the child to modulate the experience of frustration or disappointment typically elicited by these social challenges, which may in turn reduce the likelihood of extreme negative emotional expressions, venting, or aggression. The regulation of fear is also relevant to children's social adjustment; this connection has largely been discussed in reference to children who experience greater fear of novel situations or people. The ability to downregulate social fear may allow children to more successfully initiate and maintain social interactions and thus decrease the likelihood of social reticence, isolation, or exclusion (Coplan, Prakash, O'Neil, & Armer, 2004). Regulation of positive emotion is also relevant to social adjustment. Children may be expected to regularly experience positive emotions during enjoyable social interactions; however, extremely high levels of positive affect may not be well-received by peers and may be considered socially inappropriate in certain contexts (Dollar & Stifter, 2012). Lastly, the regulation of positive emotions and negative emotions may support one another (Fredrickson et al., 2000). Children who are able to successfully regulate their negative emotions

may have a greater readiness to experience and share positive emotions in social situations; similarly, children who are able to upregulate positive emotions in lieu of negative emotions in the face of social fear or challenge may ultimately display more socially competent reactions. Taken together, ER skills appear to allow children to respond to individual social challenges with adaptive levels of both positive and negative emotion, thus supporting more competent interactions in the social setting. Consistent with this view, mediational studies find that the associations between ER and peer outcomes may be accounted for by the fact that children with better ER display greater social skills, cooperation, leadership, and ego resiliency, or the ability to be flexible and adapt to different circumstances and stressors (Blair et al., 2016; Spinrad et al., 2006).

Similarly, ER relates to many sociomoral outcomes. It is argued that children who are better at regulating their emotions will be less likely to experience self-oriented personal distress in response to others' misfortune and more likely to experience other-oriented sympathy and empathy responses (Eisenberg, 2000; Eisenberg, Hofer, Sulik, & Spinrad, 2014). Thus, measures of emotion-related regulation are found to relate to measures of situational and dispositional empathy and the manifestation of other-oriented behaviors in response to others' needs. Accordingly, measures of ER are found to relate to greater prosocial behavior, an association that is mediated by levels of sympathy and trust in others (Song, Colasante, & Malti, 2017).

Beyond measures of social adaptation, ER has also emerged as a meaningful predictor of children's academic success and school-readiness (Denham et al., 2013; Eisenberg, Sadovsky, & Spinrad, 2005; Graziano, Reavis, Keane, & Calkins, 2007; Kwon, Hanrahan, & Kupzyk, 2017). One potential explanation for this association is that ER is conceptually tied to many different measures of cognitive and attentional processing and regulation, particularly for children who display higher emotional reactivity (Blair, 2002; Calkins & Marcovitch, 2010; Ursache et al., 2013). ER is also found to support memory processes that could encourage consolidation of educational information (Davis & Levine, 2013). In either case, ER appears to support competent cognitive processes, which are in turn related to more positive academic outcomes. Another path through which ER relates to academic outcomes is through its associated social advantages (Eisenberg et al., 2005; Raver, 2002). Because ER supports the development of greater social competence, better adjustment to the school setting, and better student-teacher relationship quality, these qualities in turn support the development of a generally positive academic environment that contains fewer social barriers to learning and encourages academic motivation and engagement. Because of this, well-regulated children may be open to more academic motivation and engagement, thus resulting in better academic performance. Lastly, it is important to note that ER and academic achievement may be reciprocally related over time, such that children who experience greater academic difficulties may also struggle to regulate sadness or frustration in the classroom setting, thus posing increasing challenges to academic achievement (Raver, 2002).

Converse to the positive outcomes of ER, difficulty with ER has been consistently tied to social and behavioral maladjustment (Eisenberg, Spinrad, & Eggum, 2010)). Analogous to the patterns described above, low levels of ER tend to relate to poorer social competence and peer interactions. However, certain types of ER problems may be related to specific social deficits. Difficulty regulating high levels of approach emotions like positive affect and anger may put a child at risk for problems with impulsive behavior and aggression, whereas difficulty regulating fear reactivity may lead to difficulties with social fear and anxiety.

Approaching this topic from a clinical lens, researchers have also examined the role of emotion dysregulation in many forms of developmental psychopathology. Cole, Zahn-Waxler, and Smith (1994) acknowledged that although individuals' modulation of emotion reflects an organized, moment-to-moment response to the environment, some patterns of emotion reflect maladjustment. Accordingly, emotional dysregulation reflects ER patterns that relate to impaired

functioning and/or psychopathology. Across diagnoses, an inability to regulate positive affect and anger tend to correlate relatively consistently with externalizing problems. Difficulties with fear and sadness regulation tend to pose a risk for the development of internalizing behavior problems. However, difficulty regulating approach emotions, particularly when it results in added social deficits, is also found to predict internalizing problems. Similarly, across emotion type, less-effective coping skills are found to relate to both internalizing and externalizing problems (Compas et al., 2017). Considering these and other disorders, ER has been identified as a potential trans-diagnostic risk factor relevant across many disorders such as anxiety, depression, attention deficit-hyperactivity disorder, borderline personality disorder, substance use, and eating problems (Aldao, Gee, De Los Reyes, & Seager, 2016; Sloan et al., 2017; Steinberg & Drabick, 2015). Related to this, ER skills have been identified as an important source of influence in studies of resilience to adversity and prevention of psychological disorders (Grych, Hamby, & Banyard, 2015). In both cases this suggests that ER is a meaningful target for therapeutic and intervention efforts.

Importantly, because ER reflects individuals' organized responses to environmental input, in some cases emotion dysregulation may reflect adaptation to challenging contexts (Cole et al., 1994). In other words, ER may reflect patterns of responses well adapted to an adverse environment rather than a lack of regulation. For example, a child who experiences a lack of sensitive caregiving may develop patterns of upregulating negative emotional expressions as a means to elicit parental responsiveness. Conversely, they may inhibit negative emotions to avoid punishment. Similarly, children exposed to high levels of destructive family conflict may devote many of their self-regulatory resources toward managing the distress elicited by conflict. These children may be able to mitigate this distress by displaying anger or aggression toward parents and physiological changes reflecting vigilance, but these emotional patterns tend to relate to socioemotional deficits in other contexts (Cummings & Schatz, 2012). Because of this, is important to consider the fact that children's emotional patterns that would be judged as maladaptive in typical developmental contexts may nonetheless reflect adaptive regulatory functioning.

Lastly, many studies have examined measures of regulatory functioning as a moderator of the relation between socialization influences and other developmental outcomes, such as socioemotional competence and internalizing or externalizing behavior problems. Similar to research on regulatory outcomes, the majority of studies consider the measurement of regulatory abilities through temperamental measures like effortful control. In general, the negative outcomes of harsh parenting and the positive outcomes of gentle guidance or structure appear to be stronger for children lower in regulatory abilities, especially when predicting externalizing behavior problems (Kiff et al., 2011; Slagt, Dubas, Dekovic, & van Aken, 2016).

Summary and Recommendations

Since the early 1990s the study of emotion regulation has flourished and consequently created new and provocative conceptualizations, measurements, and findings. Although not a comprehensive review, in this chapter we attempted to focus on many of the important aspects of the research in ER. Other areas of import including the physiology of ER, clinical applications and interventions, and the role of institutions and culture, are addressed in other Handbook chapters.

As with any growing field of study, limitations of the research and continuing gaps in our knowledge are expected. Accordingly, there are a number of directions that future research might take to address these issues. Below we provide a few recommendations for ER researchers to consider.

- Research in ER has examined the strategies that effectively modify the intensity and duration of emotions. Following Gross's model (Gross, 1998), ER can occur anywhere along the emotion generation process and includes antecedent strategies such as situation selec-

tion and cognitive change. These strategies are believed to emerge with development but the age at which children start to use these strategies is unknown. Likewise, parents with young children may use these antecedent strategies in their role as external regulators of their children's emotions. How parents decide to act at this early point of the emotion generation process and the consequences of their actions have not been empirically examined. Lastly, the role of temperament in the use and effectiveness of ER strategies needs further study. Temperamentally inhibited children, for example, are likely to have a lower threshold for fear over other emotions and as such may require regulation skills specific to that emotion. Understanding the temperament of a child who is having difficulty with regulating emotions can be addressed by preventative measures more specifically.

- The constructs of effortful control from the temperament field and executive function from the cognitive field are proposed to function in some way as regulators of emotion. Their specific role with regard to (1) when their influence on the development of ER emerges, (2) whether their role either supports or is critical to ER development, and (3) how they operate in the capacity to regulate emotion is a gap in the research. As both processes develop rapidly during the preschool years, this age period may be an important area for future research on their role in ER development. Many of the tasks that are used to measure both effortful control and executive function involve emotional responses such as delay of gratification, but the acknowledgement that the task evokes emotion as well as the assessment of emotion during the tasks are often ignored. Such tasks have been described as utilizing "hot" executive function to reflect the inclusion of affective and motivational processes (Zelazo & Cunningham, 2007) but more research is needed. Relatedly, attention processes are proposed to be foundational to both effortful control and executive function while many ER researchers examine attention behaviors such as gaze aversion and attention focusing as strategies for regulating emotions. Developmental researchers have begun to recognize such overlap among these constructs which has generated studies that include at least two of them (e.g., Carlson & Wang, 2007), but more research is needed.
- The measurement of ER has been a challenge, particularly at ages when the process is more internalized. The development of self-reports has attempted to address this issue but its use with children is less reliable and parent-report on their children's ER has its own issues. Adding to the challenge is the evidence comparing different measures of ER, which suggests there is little to no convergence. While we might conclude that observational, parent report and self-report measures of ER, represent components of variance rather than different assessments of the same phenomenon, the field still needs to develop ways of treating this discordance. Statistical approaches that test for latent variables, for example, may allow researchers to examine whether differing ER measures appear to emerge from a single common factor, or separable factors each with particular common characteristics, with relations to other variables of interest (e.g., Bridgett et al., 2013).
- With the advancement of theory on positive affect and its role in adaptive functioning, understanding how emotions such as joy and curiosity regulate negative affect is in need of empirical attention, especially in children. Indeed, given the unregulated expressions of joy and curiosity in the youngest children, it would be important to understand how to harness those emotions to broaden and build social, emotional, and academic resources. In addition, studying how positive affect can "undo" negative affect in children would add to the repertoire of effective ER strategies that both children and their parents could utilize. Although positive emotions can be regulating they may also reach levels that require regulation. Very little research has considered the regulation of positive affect and its consequences for behavioral adjustment.

- Much of the research on ER has been dedicated to understanding the key behaviors and processes through which socialization influences contribute to children's development of ER. There remain, however, many venues for future research on this topic. First, the existence of some inconsistent findings suggests that researchers should continue to try to resolve findings across studies. In fact, a small meta-analysis on relations between parenting and self-regulation found that the effects of positive control and negative control on ER did not differ from zero across four studies (Karreman, van Tuijl, van Aken, & Dekovic, 2006). On the other hand, a caveat with this approach is that measuring average effects by placing parenting measures into relatively aggregate categories may mask the effects of similar but functionally distinct parenting behaviors. In any case, greater clarity about both general and specific patterns of effects would give a better sense of potential targets for intervention. Secondly, the majority of research on the socialization of ER focuses on measures solely at the behavioral level, with relatively fewer studies examining physiological measures. Studies incorporating predictors of ER across multiple levels of analysis would shed more light onto shared and differential paths from parenting to distinct forms of regulatory functioning. Third, among many parenting contributions to ER highlighted in the literature, there appears to a relative lack of research examining parental ER and other emotional characteristics, particularly with longitudinal analyses. Parents' ER may mediate or moderate the influences of many other parenting qualities reviewed above, and thus serve as a potent source of socialization influence in children's regulatory development. Lastly, given the importance of caregivers in the development of ER, it is surprising that little research has been done with alternative caregivers, particularly those who work with infants and toddlers. As these age groups spend at least one-half of their day with other same-aged children in daycare settings or home-based care, understanding how alternative caregivers interact with their charges around the expression and regulation of emotion gives us an additional window onto the development of ER.
- Emotion regulation skills are implicated in a host of social and psychological outcomes, with greater ER skills typically associated with more positive adjustment across outcomes. However, one caveat with the study of ER and dysregulation in psychopathology, one that applies to ER research more generally, is that different researchers tend to use different methods and even different conceptual frameworks to examine the construct of ER (Aldao et al., 2016; Gross & Jazaieri, 2014). Accordingly, it is unclear if emotion dysregulation has been captured by any unitary construct across studies, and similarly, what facets of poor ER and/or dysregulation are the most reasonable targets for clinical interventions. Additionally, it is important to note that more ER is not necessarily an unconditionally positive quality, particularly if it reflects over-regulation and thus inflexibility to environmental stressors and challenges (Cole et al., 1994). Similarly, it is important for researchers and clinicians to continue to consider the varying ways ER may serve as a basis for deficits in functioning. It appears that ER skills generally contribute to more competent functioning, but ER may also reflect adaptation to poorer developmental conditions. Thus, although the development of ER skills may be a reasonable focus for children who demonstrate patterns of under-regulation, for other children intervention efforts may be more appropriately directed toward redirecting children's existing regulatory patterns or enacting improvements in family-level characteristics that underlie these patterns of response. Researchers should also continue to examine the role of ER in the development of competent emotional and behavioral patterns. For example, existing research suggests that ER mediates the relationship between socialization influences and child outcomes, and may thus may function as a mechanism of these effects. However, studies also find that regulatory processes moder-

ate this relationship, with stronger relations for less-regulated children. Given that socialization influences may realistically contribute to children's ER continuously across development; it is possible that both patterns exist over time based on children's ER development at different stages. Research utilizing longitudinal data with repeated measurements over time may provide stronger statistical tests of interactions and/or transactions between developmental experiences and ER in the prediction of psychosocial competence and psychopathology.

References

Adrian, M., Zeman, J., & Veits, G. (2011). Methodological implications of the affect revolution: A 35-year review of emotion regulation assessment in children. *Journal of Experimental Child Psychology, 110*(2), 171–197. https://doi.org/10.1016/j.jecp.2011.03.009

Ainsworth, M. D. S., Bell, S. M., & Stayton, D. J. (1974). Infant-mother attachment and social development: Socialisation as a product of reciprocal responsiveness to signals. In M. P. Richards (Ed.), *The integration of a child into a social world* (pp. 99–135). London: Cambridge University Press.

Aldao, A., Gee, D. G., De Los Reyes, A., & Seager, I. (2016). Emotion regulation as a transdiagnostic factor in the development of internalizing and externalizing psychopathology: Current and future directions. *Development and Psychopathology, 28*(4 pt 1), 927–946. https://doi.org/10.1017/S0954579416000638

Bariola, E., Gullone, E., & Hughes, E. K. (2011). Child and adolescent emotion regulation: The role of parental emotion regulation and expression. *Clinical Child and Family Psychology Review, 14*, 198–212. https://doi.org/10.1007/s10567-011-0092-5

Baumrind, D. (2013). Authoritative parenting revisited: History and current status. In R. E. Larzelere, A. M. Morris, & A. W. Harrist (Eds.), *Authoritative parenting: Synthesizing nurturance and discipline for optimal child development* (pp. 11–34). Washington, D.C.: American Psychological Association.

Bell, M. A., & Wolfe, C. D. (2004). Emotion and cognition: An intricately bound developmental process. *Child Development, 75*(2), 366–370. https://doi.org/10.1111/j.1467-8624.2004.00679.x

Best, J. R., & Miller, P. H. (2010). A developmental perspective on executive function. *Child Development, 81*(6), 1641–1660. https://doi.org/10.1111/j.1467-8624.2010.01499.x

Bishop, G., Spence, S., & McDonald, C. (2003). Can parents and teachers provide a reliable and valid report of behavioral inhibition. *Child Development, 74*, 1899–1917.

Blair, B. L., Gangel, M. J., Perry, N. B., O'Brien, M., Calkins, S., Keane, S. P., & Shanahan, L. (2016). Indirect effects of emotion regulation on peer acceptance and rejection: The roles of positive and negative social behaviors. *Merrill-Palmer Quarterly, 62*, 415–439. https://doi.org/10.13110/merrpalmquar1982.62.4.0415

Blair, B. L., Perry, N. B., O'Brien, M., Calkins, S., Keane, S. P., & Shanahan, L. (2015). Identifying developmental cascades among differentiated dimensions of social competence and emotion regulation. *Developmental Psychology, 51*, 1062–1073. https://doi.org/10.1037/a0039472

Blair, C. (2002). School readiness: Integrating cognition and emotion in a neurobiological conceptualization of children's functioning at school entry. *American Psychologist, 57*, 111–127. https://doi.org/10.1037/0003-066X.57.2.111

Blair, C., & Raver, C. (2015). School readiness and self-regulation: A developmental psychobiological approach. *Annual Review of Psychology, 66*(1), 711–731. https://doi.org/10.1146/annurev-psych-010814-015221

Blanchard-Fields, F., Stein, R., & Watson, T. L. (2004). Age differences in emotion-regulation strategies in handling everyday problems. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences, 59*(6), P261–P269.

Braungart, J., & Stifter, C. (1991). Regulation of negative reactivity during the strange situation: Temperament and attachment in 12-month-old infants. *Infant Behavior and Development, 14*, 349–364.

Braungart-Rieker, J., & Stifter, C. (1996). Infants' responses to frustrating situations: Continuity and change in reactivity and regulation. *Child Development, 67*(4), 1767–1779.

Braungart-Rieker, J., Zentall, S., Lickenbrock, D., Ekas, N., Oshio, T., & Planalp, E. (2014). Attachment in the making: Mother and father sensitivity and infants' responses during the Still-Face Paradigm. *Journal of Experimental Child Psychology, 125*, 63–84.

Bridges, L. J., Denham, S. A., & Ganiban, J. M. (2004). Definitional issues in emotion regulation research. *Child Development, 75*(2), 340–345. https://doi.org/10.1111/j.1467-8624.2004.00675.x

Bridgett, D. J., Oddi, K. B., Laake, L. M., Murdock, K. W., & Bachmann, M. N. (2013). Integrating and differentiating aspects of self-regulation: Effortful control, executive functioning, and links to negative affectivity. *Emotion, 13*(1), 47–63. https://doi.org/10.1037/a0029536

Buss, K. A., & Goldsmith, H. H. (1998). Fear and anger regulation in infancy: Effects on the temporal dynamics of affective expression. *Child Development, 69*(2), 359–374.

Calkins, S., & Dollar, J. (2014). Emotion: Commentary: A biopsychosocial perspective on maternal psychopathology and the development of child emotion regulation. *Journal of Personality Disorders, 28*, 70–77. https://doi.org/10.1521/pedi.2014.28.1.70

Calkins, S., Graziano, P. A., Berdan, L. E., Keane, S. P., & Degnan, K. A. (2008). Predicting cardiac vagal regulation in early childhood from maternal-child relationship quality during toddlerhood. *Developmental Psychobiology, 50*, 751–766. https://doi.org/10.1002/dev.20344

Calkins, S., & Keane, S. P. (2004). Cardiac vagal regulation across the preschool period: Stability, continuity, and implications for childhood adjustment. *Developmental Psychobiology, 45*(3), 101–112. https://doi.org/10.1002/dev.20020

Calkins, S., & Leerkes, E. (2004). Early attachment processes and the development of emotional self-regulation. In K. Vohs & R. Baumeister (Eds.), *Handbook of self-regulation: Research, theory, and applications* (pp. 324–339). New York: Guilford Press.

Calkins, S., & Marcovitch, S. (2010). Emotion regulation and executive functioning in early development: Integrated mechanisms of control supporting adaptive functioning. In S. D. Calkins & M. A. Bell (Eds.), *Child development at the intersection of emotion and cognition* (pp. 37–57). Washington, D.C.: American Psychological Association.

Calkins, S., Smith, C. L., Gill, K. L., & Johnson, M. C. (1998). Maternal interactive style across contexts: Relations to emotional, behavioral, and physiological regulation during toddlerhood. *Social Development, 7*, 350–369. https://doi.org/10.1111/1467-9507.00072

Campos, J. J., Campos, R. G., & Barrett, K. C. (1989). Emergent themes in the study of emotional development and emotion regulation. *Developmental Psychology, 25*, 394–402.

Campos, J. J., Frankel, C. B., & Camras, L. (2004). On the nature of emotion regulation. *Child Development, 75*(2), 377–394. https://doi.org/10.1111/j.1467-8624.2004.00681.x

Carlson, S. M., & Wang, T. S. (2007). Inhibitory control and emotion regulation in preschool children. *Cognitive Development, 22*, 489–510.

Carstensen, L. L., Fung, H. H., & Charles, S. T. (2003). Socioemotional selectivity theory and the regulation of emotion in the second half of life. *Motivation and Emotion, 27*(2), 103–123. doi:0146-7239/03/0600-0103/0.

Carstensen, L. L., Pasupathi, M., Mayr, U., & Nesselroade, J. R. (2000). Emotional experience in everyday life across the adult life span. *Journal of Personality and Social Psychology, 79*, 644–655.

Cassidy, J. (1994). Emotion regulation: Influences of attachment relationships. *Monographs of the Society for Research in Child Development, 59*(2/3), 228–249. https://doi.org/10.1111/j.1540-5834.1994.tb01287.x

Cassidy, J., Jones, J. D., & Shaver, P. R. (2013). Contributions of attachment theory and research: A framework for future research, translation, and policy. *Development and Psychopathology, 25*(4 Pt 2), 1415–1434. https://doi.org/10.1017/S0954579413000692

Chang, L., Schwartz, D., Dodge, K. A., & McBride-Chang, C. (2003). Harsh parenting in relation to child emotion regulation and aggression. *Journal of Family Psychology, 17*, 598–606. https://doi.org/10.1037/0893-3200.17.4.598

Cipriano, E., & Stifter, C. (2010). Predicting preschool effortful control from toddler temperament and parenting behavior. *Journal of Applied Developmental Psychology, 31*(3), 221–230. https://doi.org/10.1016/j.appdev.2010.02.004

Cole, P. (1986). Children's spontaneous control of facial expressions. *Child Development, 57*, 1309–1321.

Cole, P., Armstrong, L., & Pemberton, C. (2010). The role of language in the development of emotion regulation. In S. Calkins & M. Bell (Eds.), *Human brain development. Child development at the intersection of emotion and cognition* (pp. 59–77). Washington, D.C.: Amerian Psychological Association.

Cole, P., Dennis, T. A., Smith-Simon, K. E., & Cohen, L. H. (2009). Preschoolers' emotion regulation strategy understanding: Relations with emotion socialization and child self-regulation. *Social Development, 18*(2), 324–352. https://doi.org/10.1111/j.1467-9507.2008.00503.x

Cole, P., Martin, S., & Dennis, T. (2004). Emotion regulation as a scientific construct: Methodological challenges and directions for child development research. *Child Development, 75*(2), 317–333.

Cole, P., Tan, P., Hall, S., Zhang, Y., Crnic, K., Blair, C., & Li, R. (2011). Developmental changes in anger expression and attention focus: Learning to wait. *Developmental Psychology, 47*(4), 1078–1089. https://doi.org/10.1037/a0023813

Cole, P., Zahn-Waxler, C., Fox, N., Usher, B. W., & Welsh, J. D. (1996). Individual differences in emotion regulation and behavior problems in preschool children. *Journal of Abnormal Psychology, 105*, 518–529.

Cole, P., Zahn-Waxler, C., & Smith, K. D. (1994). Expressive control during a disappointment – Variations related to preschoolers behavior problems. *Developmental Psychology, 30*(6), 835–846.

Compas, B. E., Jaser, S. S., Bettis, A. H., Watson, K. H., Gruhn, M. A., Dunbar, J. P., & Thigpen, J. C. (2017). Coping, emotion regulation, and psychopathology in childhood and adolescence: A meta-analysis and narrative review. *Psychological Bulletin, 143*, 939–991. https://doi.org/10.1037/bul0000110

Coplan, R. J., Prakash, K., O'Neil, K., & Armer, M. (2004). Do you "want" to play? Distinguishing between conflicted shyness and social disinterest in early childhood. *Developmental Psychology, 40*(2), 244–258. https://doi.org/10.1037/0012-1649.40.2.244

Crespo, L. M., Trentacosta, C. J., Aikins, D., & Wargo-Aikins, J. (2017). Maternal emotion regulation and children's behavior problems: The mediating role of child emotion regulation. *Journal of Child and Family Studies, 26*, 2797–2809. https://doi.org/10.1007/s10826-017-0791-8

Crockenberg, S., & Leerkes, E. (2004). Infant and maternal behaviors regulate infant reactivity to novelty at 6 months. *Developmental Psychology, 40*(6), 1123–1132. https://doi.org/10.1037/0012-1649.40.6.1123

Cummings, E. M., & Davies, P. T. (1994). *Children and marital conflict: The impact of family dispute and resolution*. New York: Guilford.

Cummings, E. M., & Schatz, J. N. (2012). Family conflict, emotional security, and child development: Translating research findings into a prevention program for community families. *Clinical Child and Family Psychology Review, 15*, 14–27. https://doi.org/10.1007/s10567-012-0112-0

Davidov, M., & Grusec, J. E. (2006). Untangling the links of parental responsiveness to distress and warmth to child outcomes. *Child Development, 77*(1), 44–58. https://doi.org/10.1111/j.1467-8624.2006.00855.x

Davidson, R., Fox, A., & Kalin, N. (2007). Neural bases of emotion regulation in nonhuman primates and humans. In J. Gross (Ed.), *Handbook of emotion regulation* (pp. 47–68). New York: Guilford.

Davis, E. L., & Levine, L. J. (2013). Emotion regulation strategies that promote learning: Reappraisal enhances children's memory for educational information. *Child Development, 84*(1), 361–374. https://doi.org/10.1111/j.1467-8624.2012.01836.x

Denham, S. A. (1998). *Emotional development in young children*. New York: Guilford.

Denham, S. A., Bassett, H. H., Sirotkim, Y. S., & Zinsser, K. (2013). Head start preschoolers' emotional positivity and emotion regulation predict their social-emotion behavior, classroom adjustment, and early school success. *NHSA Dialog, 16*, 18–33.

Denham, S. A., Blair, K. A., DeMulder, E., Levitas, J., Sawyer, K., Auerbach-Major, S., & Queenan, P. (2003). Preschool emotional competence: Pathway to social competence? *Child Development, 74*, 238–256. https://doi.org/10.1111/1467-8624.00533

Dennis, T. (2006). Emotional self-regulation in preschoolers: The interplay of child approach reactivity, parenting, and control capacities. *Developmental Psychology, 42*(1), 84–97.

Dennis, T. (2010). Neurophysiological markers for child emotion regulation from the perspective of emotion–cognition integration: Current directions and future challenges. *Developmental Neuropsychology, 35*(2), 212–230.

Diener, M., Mangelsdorf, S., McHale, J., & Frosch, C. (2002). Infants' behavioral strategies for emotion regulation with fathers and mothers: Associations with emotional expressions and attachment quality. *Infancy, 3*, 153–174.

Dollar, J., & Stifter, C. (2012). Temperamental surgency and emotion regulation as predictors of childhood social competence. *Journal of Experimental Child Psychology, 112*(2), 178–194.

Duncombe, M. E., Havighurst, S. S., Holland, K. A., & Frankling, E. J. (2012). The contribution of parenting practices and parent emotion factors in children at risk for disruptive behavior disorders. *Child Psychiatry and Human Development, 43*(5), 715–733. https://doi.org/10.1007/s10578-012-0290-5

Eisenberg, N. (2000). Emotion, regulation, and moral development. *Annual Review of Psychology, 51*, 665–697. https://doi.org/10.1146/annurev.psych.51.1.665

Eisenberg, N., Cumberland, A., & Spinrad, T. L. (1998). Parental socialization of emotion. *Psychological Inquiry, 9*(4), 241–273.

Eisenberg, N., & Fabes, R. A. (1992). *Emotion and its regulation in early development*. San Francisco: Jossey-Bass.

Eisenberg, N., Hofer, C., Sulik, M. J., & Spinrad, T. L. (2014). Self-regulation, effortful control, and their socioemotional correlates. In J. J. Gross (Ed.), *Handbook of emotion regulation* (2nd ed., pp. 157–172). New York: Guilford Press.

Eisenberg, N., & Morris, A. (2002). Children's emotion-related regulation. In R. V. Kail (Ed.), *Advances in child development and behavior* (Vol. 30, pp. 190–229). San Diego, CA: Academic.

Eisenberg, N., Sadovsky, A., & Spinrad, T. L. (2005). Associations of emotion-related regulation with language skills, emotion knowledge, and academic outcomes. *New Directions for Child and Adolescent Development, 2005*(109), 109–118.

Eisenberg, N., & Spinrad, T. L. (2004). Emotion-related regulation: Sharpening the definition. *Child Development, 75*(2), 334–339. https://doi.org/10.1111/j.1467-8624.2004.00674.x

Eisenberg, N., Spinrad, T. L., & Eggum, N. D. (2010). Emotion-related self-regulation and its relation to children's maladjustment. *Annual Review of Clinical Psychology, 6*, 495–525. https://doi.org/10.1146/annurev.clinpsy.121208.131208

Eisenberg, N., Zhou, Q., Spinrad, T. L., Valiente, C., Fabes, R. A., & Liew, J. (2005). Relations among positive parenting, children's effortful control, and externalizing problems: A three-wave longitudinal study. *Child Development, 76*(5), 1055–1071. https://doi.org/10.1111/j.1467-8624.2005.00897.x

Fabes, R. A., Poulin, R. E., Eisenberg, N., & Madden-Derdich, D. A. M. F. R. (2002). The Coping with Children's Negative Emotions Scale (CCNES): Psychometric properties and relations with children's emotional competence. *Marriage & Family Review, 34*(3–4), 285–310.

Feldman, R., Singer, M., & Zagoory, O. (2010). Touch attenuates infants' physiological reactivity to stress. *Developmental Science, 13*(2), 271–278. https://doi.org/10.1111/j.1467-7687.2009.00890.x

Fox, N. (Ed.). (1994). *The development of emotion regulation: Biological and behavioral considerations* (Vol. 59). Chicago, IL: University of Chicago Press.

Fox, N., & Calkins, S. (2003). The development of self-control of emotion: Intrinsic and extrinsic influences. *Motivation and Emotion, 27*(1), 7–26. https://doi.org/10.1023/A:1023622324898

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology. The broaden-and-build theory of positive emotions. *The American Psychologist, 56*(3), 218–226.

Fredrickson, B. L., Mancuso, R. A., Branigan, C., & Tugade, M. M. (2000). The undoing effect of positive emotions. *Motivation and Emotion, 24*(4), 237–258.

Garber, J., & Dodge, K. (Eds.). (1991). *The development of emotion regulation and dysregulation*. Cambridge: Cambridge University Press.

Garner, P. W., & Power, T. G. (1996). Preschoolers' emotional control in the disappointment paradigm and its relation to temperament, emotional knowledge, and family expressiveness. *Child Development, 67*, 1406–1419.

Gartstein, M., & Rothbart, M. (2003). Studying infant temperament via the Revised Infant Behavior Questionnaire. *Infant Behavior and Development, 26*(1), 64–86.

Gnepp, J., & Hess, D. L. (1986). Children's understanding of verbal and facial display rules. *Developmental Psychology, 22*, 103–108.

Goldsmith, H. H., & Davidson, R. J. (2004). Disambiguating the components of emotion regulation. *Child Development, 75*(2), 361–365. https://doi.org/10.1111/j.1467-8624.2004.00678.x

Gottman, J. M., Katz, L. F., & Hooven, C. (1996). Parental meta-emotion philosophy and the emotional life of families: Theoretical models and preliminary data. *Journal of Family Psychology, 10*(3), 243–268. https://doi.org/10.1037/0893-3200.10.3.243

Graziano, P. A., Reavis, R. D., Keane, S. P., & Calkins, S. (2007). The role of emotion regulation in children's early academic success. *Journal of School Psychology, 45*(1), 3–19. https://doi.org/10.1016/j.jsp.2006.09.002

Gresham, D., & Gullone, E. (2012). Emotion regulation strategy use in children and adolescents: The explanatory roles of personality and attachment. *Personality and Individual Differences, 52*(5), 616–621. https://doi.org/10.1016/j.paid.2011.12.016

Grolnick, W. S., & Pomerantz, E. M. (2009). Issues and challenges in studying parental control: Toward a new conceptualization. *Child Development Perspectives, 3*(3), 165–170. https://doi.org/10.1111/j.1750-8606.2009.00099.x

Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Journal of General Psychology, 2*, 271–299.

Gross, J. J. (2015). Emotion regulation: Current status and future prospects. *Psychological Inquiry, 26*(1), 1–26. https://doi.org/10.1080/1047840X.2014.940781

Gross, J. J., & Jazaieri, H. (2014). Emotion, emotion regulation, and psychopathology: An affective science perspective. *Clinical Psychological Science, 2*, 387–401. https://doi.org/10.1177/2167702614536164

Gross, J. J., & Thompson, R. A. (2008). Emotion regulation: Conceptual foundations. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3–24). New York: Guilford Press.

Grusec, J. E. (2011). Socialization processes in the family: Social and emotional development. *Annual Review of Psychology, 62*, 243–269. https://doi.org/10.1146/annurev.psych.121208.131650

Grych, J., Hamby, S., & Banyard, V. (2015). The resilience portfolio model: Understanding healthy adaptation in victims of violence. *Psychology of Violence, 5*, 343–354. https://doi.org/10.1037/a0039671

Gullone, E., Hughes, E. K., King, N. J., & Tonge, B. (2010). The normative development of emotion regulation strategy use in children and adolescents: A 2-year follow-up study. *Journal of Child Psychology and Psychiatry, 51*, 567–574.

Gunnar, M., & Quevedo, K. (2007). The neurobiology of stress and development. *Annual Review of Psychology, 58*, 145–173.

Halligan, S. L., Cooper, P. J., Fearon, P., Wheeler, S. L., Crosby, M., & Murray, L. (2013). The longitudinal development of emotion regulation capacities in children at risk for externalizing disorders. *Development and Psychopathology, 25*(2), 391–406. https://doi.org/10.1017/S0954579412001137

Hay, E. L., & Diehl, M. (2011). Emotion complexity and emotion regulation across adulthood. *European Journal of Ageing, 8*(3), 157–168. https://doi.org/10.1007/s10433-011-0191-7

Heron, K. E., Everhart, R. S., McHale, S. M., & Smyth, J. M. (2017). Using mobile-technology-based ecological momentary assessment (EMA) methods with youth: A systematic review and recommendations. *Journal of Pediatric Psychology, 42*(10), 1087–1107. https://doi.org/10.1093/jpepsy/jsx078

Hill-Soderlund, A., & Braungart-Rieker, J. (2008). Early individual differences in temperamental reactivity and regulation: Implications for effortful control in early childhood. *Infant Behavior and Development, 31*, 386–397.

Hudson, A., & Jacques, S. (2014). Put on a happy face! Inhibitory control and socioemotional knowledge predict emotion regulation in 5- to 7-year-olds. *Journal of Experimental Child Psychology, 123*, 36–52. https://doi.org/10.1016/j.jecp.2014.01.012

Jahromi, L., Putnam, S., & Stifter, C. (2004). Maternal regulation of infant reactivity from 2 to 6 months. *Developmental Psychology, 40*(4), 477–487. https://doi.org/10.1037/0012-1649.40.4.477

Jahromi, L., & Stifter, C. (2007). Individual differences in the contribution of maternal soothing to infant distress reduction. *Infancy, 11*(3), 255–269. https://doi.org/10.1111/j.1532-7078.2007.tb00226.x

Karreman, A., van Tuijl, C., van Aken, M. A. G., & Dekovic, M. (2006). Parenting and self-regulation in preschoolers: A meta-analysis. *Infant and Child Development, 15*(6), 561–579. https://doi.org/10.1002/icd.478

Katz, L. F., Maliken, A. C., & Stettler, N. M. (2012). Parental meta-emotion philosophy: A review of research and theoretical framework. *Child Development Perspectives, 6*(4), 417–422. https://doi.org/10.1111/j.1750-8606.2012.00244.x

Kiff, C. J., Lengua, L. J., & Zalewski, M. (2011). Nature and nurturing: Parenting in the context of child temperament. *Clinical Child and Family Psychology*

Review, 14(3), 251–301. https://doi.org/10.1007/s10567-011-0093-4

Kim, S., & Kochanska, G. (2012). Child temperament moderates effects of parent-child mutuality on self-regulation: A relationship-based path for emotionally negative infants. *Child Development, 83*, 1275–1289. https://doi.org/10.1111/j.1467-8624.2012.01778.x

Kochanska, G., & Aksan, N. (1995). Mother-child mutually positive affect, the quality of child compliance to requests and prohibitions, and maternal control as correlates of early internalization. *Child Development, 66*(1), 236–254. https://doi.org/10.1111/j.1467-8624.1995.tb00868.x

Kochanska, G., Aksan, N., & Carlson, J. J. (2005). Temperament, relationships, and young children's receptive cooperation with their parents. *Developmental Psychology, 41*(4), 648–660. https://doi.org/10.1037/0012-1649.41.4.648

Kochanska, G., Aksan, N., & Joy, M. E. (2007). Children's fearfulness as a moderator of parenting in early socialization: Two longitudinal studies. *Developmental Psychology, 43*(1), 222–237. https://doi.org/10.1037/0012-1649.43.1.222

Kochanska, G., & Knaack, A. (2003). Effortful control as a personality characteristic of young children: Antecedents, correlates, and consequences. *Journal of Personality, 71*(6), 1087–1112.

Kochanska, G., Philibert, R., & Barry, R. (2009). Interplay of genes and early mother–child relationship in the development of self-regulation from toddler to preschool age. *Journal of Child Psychology and Psychiatry, 50*(11), 1331–1338.

Kopp, C. B. (1982). Antecedents of self-regulation – A developmental perspective. *Developmental Psychology, 18*(2), 199–214. https://doi.org/10.1037/0012-1649.18.2.199

Kopp, C. B. (1989). Regulation of distress and negative emotions – A developmental view. *Developmental Psychology, 25*(3), 343–354. https://doi.org/10.1037/0012-1649.25.3.343

Kopp, C. B. (2002). Commentary: The codevelopments of attention and emotion regulation. *Infancy, 3*, 199–208.

Kwon, K., Hanrahan, A. R., & Kupzyk, K. A. (2017). Emotional expressivity and emotion regulation: Relation to academic functioning among elementary school children. *School Psychology Quarterly, 32*(1), 75–88. https://doi.org/10.1037/spq0000166

Leerkes, E., Nayena Blankson, A., & O'Brien, M. (2009). Differential effects of maternal sensitivity to infant distress and nondistress on social-emotional functioning. *Child Development, 80*(3), 762–775. https://doi.org/10.1111/j.1467-8624.2009.01296.x

Lewis, M. (2000). Self-conscious emotions: Embarassment, pride, shame, and guilt. In M. Lewis & J. Havilland (Eds.), *Handbook of emotions* (2nd ed., pp. 623–636). New York: Guilford.

Lewis, M. D., & Stieben, J. (2004). Emotion regulation in the brain: Conceptual issues and directions for developmental research. *Child Development, 75*(2), 371–376. https://doi.org/10.1111/j.1467-8624.2004.00680.x

Mathis, E. B., & Bierman, K. L. (2015). Dimensions of parenting associated with child prekindergarten emotion regulation and attention control in low-income families. *Social Development, 24*, 601–620. https://doi.org/10.1111/sode.12112

Meyer, S., Raikes, H. A., Virmani, E. A., Waters, S., & Thompson, R. A. (2014). Parent emotion representations and the socialization of emotion regulation in the family. *International Journal of Behavioral Development, 38*(2), 164–173. https://doi.org/10.1177/0165025413519014

Mirabile, S. P., Scaramella, L. V., Sohr-Preston, S. L., & Robison, S. D. (2008). Mothers' socialization of emotion regulation: The moderating role of children's negative emotional reactivity. *Child & Youth Care Forum, 38*, 19. https://doi.org/10.1007/s10566-008-9063-5

Moed, A., Dix, T., Anderson, E. R., & Greene, S. M. (2017). Expressing negative emotions to children: Mothers' aversion sensitivity and children's adjustment. *Journal of Family Psychology, 31*(2), 224–233. https://doi.org/10.1037/fam0000239

Morelen, D., Shaffer, A., & Suveg, C. (2016). Maternal emotion regulation: Links to emotion parenting and child emotion regulation. *Journal of Family Issues, 37*(13), 1891–1916. https://doi.org/10.1177/0192513X14546720

Morris, A. S., Silk, J. S., Morris, M. D., Steinberg, L., Aucoin, K. J., & Keyes, A. W. (2011). The influence of mother-child emotion regulation strategies on children's expression of anger and sadness. *Developmental Psychology, 47*(1), 213–225. https://doi.org/10.1037/a0021021

Morris, A. S., Silk, J. S., Steinberg, L., Myers, S. S., & Robinson, L. R. (2007). The role of the family context in the development of emotion regulation. *Social Development, 16*(2), 361–388. https://doi.org/10.1111/j.1467-9507.2007.00389.x

Network, N. E. C. C. R. (2004). Affect dysregulation in the mother-child relationship in the toddler years: Antecedents and consequences. *Development and Psychopathology, 16*, 43–68. https://doi.org/10.1017/S0954579404044402

O'Hare, E., Sowell, E., Nelson, C., & Luciana, M. (2008). Imaging developmental changes in gray and white matter in the human brain. In C. Nelson & M. Luciana (Eds.), *Handbook of developmental cognitive neuroscience* (2nd ed., pp. 23–38). Cambridge, MA: MIT Press.

Papousek, M. (2007). Communication in early infancy: An arena of intersubjective learning. *Infant Behavior & Development, 30*(2), 258–266. https://doi.org/10.1016/j.infbeh.2007.02.003

Parade, S. H., & Leerkes, E. M. (2008). The reliability and validity of the Infant Behavior Questionnaire-Revised. *Infant Behavior & Development, 31*(4), 637–646. https://doi.org/10.1016/j.infbeh.2008.07.009

Perry, N. B., Calkins, S., & Bell, M. A. (2016). Indirect effects of maternal sensitivity on infant emotion regulation behaviors: The role of vagal withdrawal. *Infancy, 21*(2), 128–153. https://doi.org/10.1111/infa.12101

Perry, N. B., Nelson, J. A., Swingler, M. M., Leerkes, E., Calkins, S., Marcovitch, S., & O'Brien, M. (2013). The relation between maternal emotional support and child physiological regulation across the preschool years. *Developmental Psychobiology, 55*(4), 382–394. https://doi.org/10.1002/dev.21042

Porges, S. (2003). The polyvagal theory: Phylogenetic contributions to social behavior. *Physiology & Behavior, 79*(3), 503–513. https://doi.org/10.1016/S0031-9384(03)00156-2

Putnam, S., Spritz, B., & Stifter, C. (2002). Mother-child coregulation during delay of gratification at 30 months. *Infancy, 3*, 209–225. https://doi.org/10.1207/S15327078IN0302_6

Raver, C. C. (2002). Emotions matter: Making the case for the role of young children's emotional development for early school readiness. *Society for Research in Child Development Social Policy Report, 16*, 3–18.

Raver, C. C. (2004). Placing emotional self-regulation in sociocultural and socioeconomic contexts. *Child Development, 75*(2), 346–353. https://doi.org/10.1111/j.1467-8624.2004.00676.x

Roben, C. K. P., Cole, P., & Armstrong, L. M. (2013). Longitudinal relations among language skills, anger expression, and regulatory strategies in early childhood. *Child Development, 84*(3), 891–905. https://doi.org/10.1111/cdev.12027

Rothbart, M., Ahadi, S., Hershey, K., & Fisher, P. (2001). Investigations of temperament at three to seven years: The Children's Behavior Questionnaire. *Child Development, 72*(5), 1394–1408.

Rothbart, M., & Bates, J. (2006). Temperament. In R. L. W. Damon & N. Eisenberg (Eds.), *Handbook of child psychology, Sixth edition: Social, emotional, and personality development* (Vol. 3, pp. 99–166). New York: Wiley.

Rothbart, M., & Derryberry, D. (1981). Development of individual differences in temperament. In M. E. Lamb & A. L. Brown (Eds.), *Advances in developmental psychology* (Vol. 1, pp. 37–86). Hillsdale, NJ: Erlbaum.

Rothbart, M., & Rueda, M. (2005). The development of effortful control. In U. Mayr, E. Awh, & S. W. Keele (Eds.), *Developing individuality in the human brain: A tribute to Michael I. Posner* (pp. 167–188). Washington, D.C.: American Psychological Association.

Rothbart, M., Ziaie, H., & O'Boyle, C. (1992). Self-regulation and emotion in infancy. In N. Eisenberg & R. A. Fabes (Eds.), *Emotion and its regulation in early development* (pp. 7–24). San Francisco, CA: Jossey-Bass Publishers.

Shields, A., & Cicchetti, D. (1997). Emotion regulation among school-age children: The development and validation of a new criterion Q-sort scale. *Developmental Psychology, 33*(6), 906–916.

Shiner, R. L., Buss, K. A., McClowry, S. G., Putnam, S. P., Saudino, K. J., & Zentner, M. (2012). What is temperament now? Assessing progress in temperament research on the twenty-fifth anniversary of Goldsmith et al.(). *Child Development Perspectives, 6*, 436–444.

Silvers, J. A., McRae, K., Gabrieli, J. D. E., Gross, J. J., Remy, K. A., & Ochsner, K. N. (2012). Age-related differences in emotional reactivity, regulation, and rejection sensitivity in adolescence. *Emotion, 12*, 1235–1247.

Simonds, J., Kieras, J., Rueda, M. R., & Rothbart, M. K. (2007). Effortful control, executive attention, and emotional regulation in 7–10-year-old children. *Cognitive Development, 22*, 474–488.

Slagt, M., Dubas, J. S., Dekovic, M., & van Aken, M. A. (2016). Differences in sensitivity to parenting depending on child temperament: A meta-analysis. *Psychological Bulletin, 142*(10), 1068–1110. https://doi.org/10.1037/bul0000061

Sloan, E., Hall, K., Moulding, R., Bryce, S., Mildred, H., & Staiger, P. K. (2017). Emotion regulation as a transdiagnostic treatment construct across anxiety, depression, substance, eating and borderline personality disorders: A systematic review. *Clinical Psychology Review, 57*, 141–163. https://doi.org/10.1016/j.cpr.2017.09.002

Song, J. H., Colasante, T., & Malti, T. (2017). Helping yourself helps others: Linking children's emotion regulation to prosocial behavior through sympathy and trust. *Emotion, 18*, 518. https://doi.org/10.1037/emo0000332

Spinrad, T. L., Eisenberg, N., Cumberland, A., Fabes, R. A., Valiente, C., Shepard, S. A., … Guthrie, I. K. (2006). Relation of emotion-related regulation to children's social competence: A longitudinal study. *Emotion, 6*(3), 498–510. https://doi.org/10.1037/1528-3542.6.3.498

Spinrad, T. L., Stifter, C., Donelan-McCall, N., & Turner, L. (2004). Mothers' regulation strategies in response to toddlers' affect: Links to later emotion self-regulation. *Social Development, 13*(1), 40–55. doi: https://doi.org/10.1111/j.1467-9507.2004.00256.x

Stack, D. M., & Jean, A. D. L. (2011). Communicating through touch: Touching during parent-infant interactions. In *Handbook of touch: Neuroscience, behavioral, and health perspectives* (pp. 273–298).

Steinberg, E. A., & Drabick, D. A. (2015). A developmental psychopathology perspective on ADHD and comorbid conditions: The role of emotion regulation. *Child Psychiatry and Human Development, 46*(6), 951–966. https://doi.org/10.1007/s10578-015-0534-2

Steinberg, L. (2005). Cognitive and affective development in adolescence. *Trends in Cognitive Sciences, 9*(2), 69–74. https://doi.org/10.1016/j.tics.2004.12.005

Steinberg, L., & Morris, A. S. (2001). Adolescent development. *Annual Review of Psychology, 52*, 83–110.

Stifter, C., & Braungart, J. (1995). The regulation of negative reactivity in infancy: Function and development. *Developmental Psychology, 31*, 448–455.

Stifter, C., & Moyer, D. (1991). The regulation of positive affect: Gaze aversion activity during mother-infant interaction. *Infant Behavior and Development, 14*, 111–123.

Stifter, C., & Rovine, M. (2015). Modeling dyadic processes using Hidden Markov Models: A time series

approach to mother-infant interactions during infant immunization. *Infant and Child Development, 24*(3), 298–321. https://doi.org/10.1002/icd.1907

Stifter, C., & Spinrad, T. L. (2002). The effect of excessive crying on the development of emotion regulation. *Infancy, 3*, 133–152.

Stifter, C., Spinrad, T. L., & Braungart-Rieker, J. (1999). Toward a developmental model of child compliance: The role of emotion regulation in infancy. *Child Development, 70*, 21–32.

Stifter, C., Willoughby, M., & Towe-Goodman, N. (2008). Agree or agree to disagree? Assessing the convergence between parents and observers on infant temperament. *Infant and Child Development, 17*, 407–426.

Suveg, C., Shaffer, A., Morelen, D., & Thomassin, K. (2011). Links between maternal and child psychopathology symptoms: Mediation through child emotion regulation and moderation through maternal behavior. *Child Psychiatry and Human Development, 42*(5), 507–520. https://doi.org/10.1007/s10578-011-0223-8

Suveg, C., & Zeman, J. (2011). Creative applications and innovations to emotion assessment in children and adolescents: An introduction to the special section. *Journal of Experimental Child Psychology, 110*(2), 133–140. https://doi.org/10.1016/j.jecp.2011.04.006

Tan, P. Z., Forbes, E. E., Dahl, R. E., Ryan, N. D., Siegle, G. J., Ladouceur, C. D., & Silk, J. S. (2012). Emotional reactivity and regulation in anxious and nonanxious youth: A cell-phone ecological momentary assessment study. *Journal of Child Psychology and Psychiatry, 53*(2), 197–206. https://doi.org/10.1111/j.1469-7610.2011.02469.x

Thompson, R. A. (1994). Emotion regulation: In search of definition. In N. A. Fox (Ed.), *Monographs of the Society for Research in Child Development: Vol. 59 (2–3). The development of emotion regulation.* (pp. 25–52, 250–283). Chicago, IL: University of Chicago Press.

Thompson, R. A. (2011). Emotion and emotion regulation: Two sides of the developing coin. *Emotion Review, 3*(1), 53–61. https://doi.org/10.1177/1754073910380969

Thompson, R. A. (2014). Socialization of emotion and emotion regulation in the family. In J. J. Gross (Ed.), *Handbook of emotion regulation* (2nd ed., pp. 173–186). New York: Guilford Press.

Thompson, R. A., & Meyer, S. (2007). Socialization of emotion regulation in the family. In J. Gross (Ed.), *Handbook of emotion regulation* (pp. 249–268). New York: Guilford.

Tugade, M. M., & Fredrickson, B. L. (2004). Resilient individuals use positive emotions to bounce back from negative emotional experiences. *Journal of Personality and Social Psychology, 86*(2), 320.

Ursache, A., Blair, C., Stifter, C., Voegtline, K., & Family Life Project, I. (2013). Emotional reactivity and regulation in infancy interact to predict executive functioning in early childhood. *Developmental Psychology, 49*(1), 127–137. https://doi.org/10.1037/a0027728

Walden, T. A., & Ogan, T. A. (1988). The development of social referencing. *Child Development, 59*(5), 1230–1240.

Walton, A., & Flouri, E. (2010). Contextual risk, maternal parenting and adolescent externalizing behaviour problems: The role of emotion regulation. *Child: Care, Health and Development, 36*(2), 275–284. https://doi.org/10.1111/j.1365-2214.2009.01065.x

Waters, S. F., & Thompson, R. A. (2016). Children's perceptions of emotion regulation strategy effectiveness: Links with attachment security. *Attachment & Human Development, 18*(4), 354–372. https://doi.org/10.1080/14616734.2016.1170051

Welsh, M., Friedman, S., & Spieker, S. (2006). Executive functions in developing children: Current conceptualizations and questions for the future. In K. McCartney & D. Phillips (Eds.), *Blackwell handbook of early childhood development* (pp. 167–187). Malden, MA: Blackwell.

Woltering, S., & Lewis, M. D. (2009). Developmental pathways of emotion regulation in childhood: A neuropsychological perspective. *Mind, Brain, and Education, 3*(3), 160–169. https://doi.org/10.1111/j.1751-228X.2009.01066.x

Zelazo, P. D., & Cunningham, W. A. (2007). Executive function: Mechanisms underlying emotion regulation. In J. Gross (Ed.), *Handbook of emotion regulation* (pp. 135–158). New York: Guilford.

Zimmer-Gembeck, M. J., Webb, H. J., Pepping, C. A., Swan, K., Merlo, O., Skinner, E. A., … Dunbar, M. (2017). Review: Is parent-child attachment a correlate of children's emotion regulation and coping? *International Journal of Behavioral Development, 41*(1), 74–93. https://doi.org/10.1177/0165025415618276

Zimmermann, P., & Iwanski, A. (2014). Emotion regulation from early adolescence to emerging adulthood and middle adulthood age differences, gender differences, and emotion-specific developmental variations. *International Journal of Behavioral Development, 38*(2), 182–194. https://doi.org/10.1177/0165025413515405

Zisner, A., & Beauchaine, T. P. (2016). Neural substrates of trait impulsivity, anhedonia, and irritability: Mechanisms of heterotypic comorbidity between externalizing disorders and unipolar depression. *Development and Psychopathology, 28*(4), 1177–1208. https://doi.org/10.1017/S0954579416000754

Children's Understanding of Emotions or Pascal's "Error": Review and Prospects

Francisco Pons and Paul L. Harris

Abstract

This chapter will address four main questions by conducting a review of the last 40 years of research on children's understanding of emotions: (1) How can we define and measure Emotion Understanding in children (including a discussion of the relation between theory of mind and Emotion Understanding)? (2) How does Emotion Understanding develop in typically developing children, and what individual differences do we observe (including a discussion of the relation between Emotion Understanding and emotional experience)? (3) How can we explain the development and individual differences in children's Emotion Understanding? (4) What is the impact of Emotion Understanding, and how can we help children to improve their Emotion Understanding? We will conclude by speculating about the origins of Emotion Understanding in Piagetian first-hand observation and in the testimony provided by other people. More broadly, we will try to show that Blaise Pascal's dictum – "The heart has its reasons, that reason does not know" (Pascal, Preuve de la religion par le peuple juif, les prophéties et quelques discours, 1662, p. 251) – is wrong, at least for children, if we accept, as many today do, that "reason" stands for understanding and the "heart" stands for emotion.

Introduction

At the end of the 1970s, a revolution took place in developmental psychology. Thanks to the decline of behaviorism, we were already allowed to investigate the black box, the mind, intervening between environmental and physiological stimuli and behavioral and physiological responses. But now we were also inspired to think about the knowledge that children have about this black box of the mind.[1] From the start, two main lines of research emerged depending on whether children were regarded as little cognitive scientists (Brown, 1978; Flavell, 1979) or little affective scientists (Harris, Olthof, & Meerum Terwogt, 1981). The first line of research has often been designated by the term "theory of mind" (and "metacognitive knowledge") and the second line by the term "Emotion Understanding" (and "meta-emotional knowledge").

[1]Piaget's research on children's egocentrism with the so-called three mountains task can be considered as one of the precursors of this revolution (Piaget and Inhelder, 1948; Meyer, 1935).

F. Pons (✉)
University of Oslo, Oslo, Norway
e-mail: francisco.pons@psykologi.uio.no

P. L. Harris
Harvard University, Cambridge, MA, USA

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_17

Theory of mind and Emotion Understanding are both expressions of the capacity of the mind to reflect on itself; they are second-order mental representations (meta-representations) about first-order mental representations. In the case of theory of mind, the first-order mental representations are percepts, ideas, knowledge, mental images, inner speech, memories, etc., whereas in the case of Emotion Understanding, they are affects, moods, feelings, emotions, etc. With respect to both theory of mind and Emotion Understanding, these first-order mental representations are conceived as determining our perception and understanding of both the inner and external world (self, others, environment) and therefore as having an impact on our individual and social behaviors (from individual sensorimotor actions to collective discourse). These first-order mental representations are conceived as potentially true or false (objective, logical, efficient, intersubjective, etc.), similar or different from one individual to another or from one situation to another, and "naturally" variable depending on age and time or voluntarily (controllable and manipulable). In summary, Emotion Understanding is to emotion what theory of mind is to cognition. Emotion Understanding is cognition about emotion, whereas theory of mind is cognition about cognition.

This chapter will address four main questions by conducting a review of the last 40 years of research on children's understanding of emotions: (1) How can we define and measure Emotion Understanding in children (including a discussion of the relation between theory of mind and Emotion Understanding)? (2) How does Emotion Understanding develop in typically developing children, and what individual differences do we observe (including a discussion of the relation between Emotion Understanding and emotional experience)? (3) How can we explain the development and individual differences in children's Emotion Understanding? (4) What is the impact of Emotion Understanding, and how can we help children to improve their Emotion Understanding? We will conclude by speculating about the origins of Emotion Understanding in Piagetian first-hand observation and in the testimony provided by other people. More broadly, we will try to show that Blaise Pascal's dictum – "The heart has its reasons, that reason does not know" (Pascal, 1662, p. 251) – is wrong, at least for children, if we accept, as many today do, that "reason" stands for understanding and the "heart" stands for emotion.

Because of limits on space, we will not discuss Emotion Understanding in atypically developing children (children with anxious disorders, autism, Down syndrome, etc.) (see Bender, Pons, Harris, Esbjørn, & Reinholdt-Dunne, 2015 for a recent review) or the impact of culture (including religion) on Emotion Understanding (see Pons, Bernaschina, Harris & Fiske, 2018; Tang et al., 2018 for recent reviews).

How Can We Define and Measure Emotion Understanding in Children?

How Can We Define Emotion Understanding?

The study of children's understanding of emotions suffers from the same "curse" as many concepts in psychology: a multiplicity of more or less explicit definitions and a multiplicity of measures. The goal of this chapter is not to consider the reasons for this multiplicity (e.g., the complexity of the phenomenon, its accessibility, and the diversity of the researchers and their theoretical background). Instead, the goal is to offer a definition of Emotion Understanding that is as broad and inclusive as possible.

Emotional competence has at least two aspects: an experiential aspect and a declarative aspect. Emotional experience is the capacity to feel emotions, to express emotions, to control the expression of emotions, and to regulate the course of emotions. The declarative aspect, notably Emotion Understanding, is the capacity *to understand the nature, causes, and consequences of the emotional experience in the self and others. Its main function is to identify, explain, predict, and enable change in everyday emotional experience.*[2]

[2]Emotions can be conceived as mental states or traits caused by and causing changes in the mind, the body (including the brain), the behavior, and the environment (physical and social). They can be more or less pleasant or

Several core components of Emotion Understanding have been identified during the last 40 years (see Harris, de Rosnay, & Pons, 2016; Pons, et al., 2015; Wellman, 2014 for recent reviews). Below, we list some of the most investigated or important. They can be divided into three groups depending on whether they are related to understanding the nature of emotions, their antecedents, or their consequences.

Understanding the Nature of Emotions

- From the age of 1–2 years, with the emergence of language, children start to label basic emotions such as happiness, fear, anger, and sadness from facial expressions, postures, movements, and voice prosody (e.g., recognizing that a person is sad by the tone of his voice, the posture of his body, or the expression of his face). At the age of 4–5 years, most children can recognize and label not only these basic emotions but also others such as surprise and disgust.
- From the age of 4–5 years, children start to understand the distinction between the appearance (expression) and the reality (actual experience) of emotions. They understand that emotions may be overtly simulated even if the actual experience is ultimately private (e.g., they understand that a person who smiles is not necessarily happy and that a person who cries is not necessarily sad). At the age of 7–8 years, the majority of children understand that you can hide your emotions either for personal or social reasons (display rules).
- From the age of 7–8 years, children start to understand the mixed and conflictual nature of some emotions (e.g., understanding that we can feel both happy and scared on a rollercoaster). At the age of 10–11 years, the majority of children understand mixed emotions.
- From the age of 7–8 years, children start to understand the reflective nature of certain emotions. They understand that emotions can be oriented either partly or entirely toward the self (guilt, shame, pride, depression, love, hate, empathy, etc.) or toward others (love, hate, jealousy, envy, empathy, *kama muta*, embarrassment, etc.). By the age of 10–11 years, the majority of the children understand an increasing number of self-reflective and moral emotions.

Understanding the Antecedents of Emotions

- From the age of 2–3 years, children start to understand the impact of the situation (i.e., the social and physical environment) on emotions. For example, they understand that a person is likely to feel happy when receiving a birthday gift or frightened when being chased by a fierce dog). By the age of 4–5 years, most children understand the impact of a variety of prototypical situations on emotions.
- From the age of 2–3 years, children start to understand the impact of individual desires on emotions. For example, they understand that two people facing the same situation – both are thirsty and have only milk to drink – may feel different emotions because one likes milk and the other does not. By the age of 4–5 years, most children understand the impact of desires on emotions.
- From the age of 4–5 years, children start to understand the impact of time on emotions. For example, they understand that the intensity of an emotion fades over time. By the age of 7–8 years, most children understand the time course of emotion.
- From the age of 4–5 years, children start to understand the impact of reminders on emotions. For example, they understand that looking at an object that belonged to a loved one or eating a madeleine can revive past emotions. By the age of 7–8 years, most

unpleasant, moderate or intense, brief or long lasting, attached to one specific object or diffuse, oriented toward the self or toward others, conscious or unconscious, real or apparent, motivational (i.e., action-inducing) or attentional (process-guiding), etc. They can be more or less basic (happy, sad, angry, scared, disgusted, surprised, etc.) mixed, social, and reflective (empathy, *kama muta*, pride, shame, guilt, etc.).

children understand the impact of reminders on emotions.
- From the age of 4–5 years, children start to understand the impact of knowledge and (false) beliefs on emotions. For example, they understand that a rabbit eating a carrot feels happy even if a fox is hiding behind a nearby bush. By the age of 7–8 years, most children understand that our emotions are related to our beliefs.
- From the age of 4–5 years, children start to understand the impact of age on emotions. For example, they understand that toddlers have fewer emotion words than adolescents. By the age of 10–11 years, most children understand that both nature (maturation of the brain) and nurture (education) can explain these age differences.
- From the age of 4–5 years, children start to understand how emotions can be regulated through behavioral and social strategies. For example, they understand that it is possible to reduce sadness via physical activity or by seeking social support. By the age of 10–11 years, most children also understand that emotions can be regulated through cognitive strategies (e.g., by thinking about something positive in order to stop being sad).
- From the age of 7–8 years, children start to understand the impact of morality on emotions. For example, they understand that we may feel guilty after a transgression or proud after resisting temptation. By the age of 10–11 years, most children understand that the violation or maintenance of moral rules can impact our emotions.

New lines of research are starting to investigate children's understanding of the impact of personality on emotions (e.g., understanding that because of their personality some people react to frustration, with anger, others with sadness) and of culture (and religion) on emotions (e.g., understanding that people from different cultures (and religions) have different display rules and react differently because of their religious or cultural values). It is too early to say at what age children start to have such understanding or whether and when most children eventually understand the impact of personality, culture, and religion on emotions.

Understanding the Consequences of Emotions

- From the age of 4–5 years, children start to understand the impact of emotions on behavior. For example, they understand that it is easier to play with someone you love and more difficult to share with someone you do not love. By the age of 10–11 years, most children understand the impact of emotions on behavior.
- From the age of 4–5 years, children start to understand the impact of emotions on cognitive processes, such as academic performance. For example, they understand that an anxious person will have difficulty solving a math problem or that a person who feels confident will be better able to recite a poem in public. By the age of 10–11 years, most children understand the impact of emotions on cognition.

A new line of research is starting to investigate children's understanding of the impact of emotions on emotions (e.g., understanding that anger or pride can evoke guilt or shame, or that the fear and anxiety can cause anger). It is too early to say at what age children start to understand the impact of emotions on emotions or when the majority of the children are capable of such understanding.

How Can We Measure Emotion Understanding in Children?

Currently, many instruments (tests, questionnaires, interviews, etc.) are available to assess Emotion Understanding from early childhood to adulthood (see Castro, 2016 for a review). However, many of these instruments call for expertise, take time to administer and to score, have limited reliability, assess only one or two

core components of Emotion Understanding (typically, the basic components), have limited validity, can be used only with younger children or only with older children (but not both), are demanding in terms of language production and/or comprehension, and are occasionally expensive (thereby limiting access).

These limitations inspired the construction of the Test of Emotion Comprehension – TEC (Pons & Harris, 2000). The TEC is based on an extensive review of the literature on Emotion Understanding in children (see Harris et al., 2016; Pons, et al., 2015; Wellman, 2014 for recent reviews). The TEC does not require any special expertise to administer and score and yet it offers a reliable measure of Emotion Understanding. Depending on the particular version that is used, it takes, on average, between 15 and 30 min to administer and score, which is useful when working with young children or running many assessments within the same session. The standard version can be used with children ranging from 1–2 years up to 11–12 years of age (the same method is used to assess children whatever their age). It makes no demands in terms of language production (children's answers can be given via pointing) and only limited demands in terms of language comprehension (the questions for any given component are kept as simple as possible). It is not costly to reproduce and its distribution is free. The reliability and validity (content, construct, and criterion) of the TEC have also been positively evaluated.

The early version of the TEC (TEC 1.2) assesses nine core components of Emotion Understanding that vary in complexity: (i) recognition and naming of the facial expressions for five basic emotions (happy, sad, angry, scared, alright); understanding the impact of (ii) external situations, (iii) desires, (iv) reminders, and (v) beliefs on emotions; (vi) understanding the control of the expression of emotions; (vii) understanding the regulation of the experience of emotions via psychological strategies; (viii) understanding the potentially mixed nature of emotions (ambivalence); and (ix) understanding moral and reflective emotions (pride, shame, guilt). The latest version of the TEC (TEC 2.0) assesses three additional components: (x) understanding the impact of emotions on cognition (school achievement), (xi) understanding the impact of culture on emotions, and (xii) understanding how emotions can be regulated via social and behavioral strategies. Different scores can be calculated with the TEC: success on each specific core component of Emotion Understanding (with rounding-up on items passed) to the overall level of Emotion Understanding (addition of the core components passed, from 0 to 9 on the TEC 1.2 and from 0 to 12 on the TEC 2.0).

So far, the TEC has been translated and adapted into more than 27 languages (in alphabetical order): Amharic (Ethiopia), Arabic (Lebanon), Catalan (Catalonia), Danish, Dutch, English (UK, US, CA, IR), Fongbé (Benin), French (Belgium, Côte d'Ivoire, France, Quebec Switzerland), Georgian, German (Germany), Greek, Hebrew (Israel), Icelandic, Indonesian (Bahasa), Italian, Japanese, Macedonian, Mandarin (China, Taiwan), Norwegian (Bokmål), Polish, Portuguese (Angola, Brazil, and Portugal), Quechua (Peru), Russian, Rumanian, Serbo-Croatian (Bosnia and Herzegovina), Spanish-Castellan (Argentina, Colombia, Peru, and Spain), and Turkish. It is used by numerous clinical, educational, and research institutions. It is used as an independent variable (e.g., to evaluate the impact of Emotion Understanding on mental health, psychological well-being, social competence, or school achievement), as a dependent variable (e.g., to evaluate the effect of intervention programs seeking to improve Emotion Understanding or more generally emotional competence), and as a control and neutralized variables. Clinical and educational institutions use the TEC to assess whether the child has a circumscribed or more extensive problem in the understanding of emotion, to compare the child to his or her population of reference (clinical or nonclinical) and to introduce the child to the topic of emotion.

How Does Emotion Understanding Develop During Childhood and How Do Children Vary in Their Understanding?

How Does Emotion Understanding Develop During Childhood?

Children's understanding of emotion changes in the course of development. In accordance with Piaget's hypothesis about the development of consciousness "from the periphery to the center of the subject and the object" (Piaget, 1974; Pons, Harris, & de Rosnay, 2012), children's understanding of emotions develops from a limited understanding of the more visible and automatic aspects of emotions to a deeper understanding of the more invisible and ruminative aspects of emotion. With age, children progress through a series of landmarks in their understanding of emotion – with respect to both the self and others.

Within the framework of this chapter, we propose a three-stage division of Emotion Understanding development from early childhood to preadolescence. This three-stage division is based on an extensive review of the literature as well as data collected with the TEC 1.2 since the early 2000s. It should be noted that Emotion Understanding during infancy and after puberty (adulthood, life-span) in typically developing and atypically developing individuals (ASD, Down syndrome, etc.) and in nonhuman primates or other animals will not be discussed in this chapter because of a lack of space. It should also be noted that the ages given are approximations. First, they may vary considerably depending on the exact method used to assess children's Emotion Understanding and second, as we shall see in the next section, the range of individual differences is considerable even among typically developing children.

The Three Stages of Emotion Understanding Development in Typical Children

During the first *external* stage (1–2 to 4–5 years), children start to name and identify basic emotions such as happiness, sadness, fear, anger, surprise, and disgust. In making these identifications, children are not confined to present reality; they can talk about imagined emotions (e.g., of fictional characters) and they can talk about emotions that were experienced in the past and may be experienced in the future. In the course of development, children are able to identify an increasing number of emotions with greater subtlety, such as guilt, shame, pride, contempt, or embarrassment. During this stage, children also begin to recognize certain external situations that cause emotions. For example, they recognize that losing a cherished object can cause sadness and that receiving a gift can cause joy. They also understand that the external causes of emotion can include imaginary contexts. For example, they realize that being chased by a monster can cause fear. Children also begin to understand the influence of desires on emotions. Although they are able to make links between desires and emotions from around 2 to 3 years of age, they have difficulty in conceptualizing how individuals can entertain opposing or conflicting desires. It is not until about 4 years of age that they understand that two people facing the same situation (e.g., who are both thirsty and find a bottle full of milk) but with different desires (one person likes milk, whereas the other hates milk) can experience different emotions (pleasure and displeasure, respectively).

During the second *mental* stage (4–5 to 7–8 years), children begin to have a better understanding of the impact of psychological phenomena such as memory and knowledge on emotions. They also come to distinguish between the external expression of emotion and its inner experience. At around the age of 5 years, children begin to understand the effect of reminders on emotions. For example, they realize that, in the absence of reminders, the intensity of anger decreases over time, whereas looking at a picture of a lost loved one can cause sadness. Children also begin to realize that it is possible to simulate or to hide an emotion. Thus, someone can cry when in reality she is not sad or smile even if she is unhappy. At around 5 years of age, most children understand that people's expectations may be true or false. Although 3-year-olds assume

that Little Red Riding Hood knows about the wolf inside her grandmother's cottage, 5-year-olds realize that she does not. Yet many 5-year-olds say that she must be afraid of the wolf as she knocks at the door – the very wolf that she does not know about! Thus, even though children know that Little Red Riding Hood does not know, still they cannot stop being afraid on her behalf. By the age of 6–7 years, children typically grasp the full implications of Little Red Riding Hood's naïveté. They understand not only that she fails to realize that a wolf is waiting inside the cottage, but also that, as a result, she feels no fear, even if they themselves are anxious for her. They attribute an emotion to her that is consistent with what she knows rather than with what they know themselves.

During the third *reflexive* stage (7–8 to 10–11 years), children begin to understand the mixed nature of some emotions, the effect of moral rules on certain emotions, and the possibility of controlling the experience of emotion via mental strategies. At around the age of 8 years, children realize that a person may feel guilty after doing something morally reprehensible such as stealing a desired object or lying. Conversely, they also realize that a person may feel proud after doing something morally valued such as resisting temptation or making a sacrifice for another person. During this stage, children also begin to understand that a person can simultaneously experience different or even conflicting emotions. For example, a person can be happy to have found his favorite pet and at the same time sad or angry to find out the pet has been hurt. During this stage, children also begin to understand how to control the experience of emotion via psychological strategies. For example, they understand that thinking about something pleasant can help a person stop feeling sad, thinking about something sad can help a person stop laughing, whereas talking about an unpleasant emotional episode can decrease the intensity of the emotion.

Research with the TEC 1.2 has revealed a continuous quantitative development in children's overall level of Emotion Understanding from 1–2 to 8–9 core components between the ages of 1–2 and 10–11 years. For example, at the age of 4 years, the average overall level is 3, at the age of 6 years, the average overall level is 5, and at the age of 8 years, the average overall level is 7. It also confirmed that the emergence of these nine core components can be grouped into three qualitatively different hierarchical stages, where earlier stages are a necessary (albeit not sufficient) condition for the emergence of the later stage: external stage (2–5 years), (i) recognition and naming of facial expressions of basic emotions (happy, sad, angry, scared), (ii) understanding the impact of external causes on emotions, and (iii) understanding the impact of desires on emotions; mental stage (4–8 years), (iv) understanding the impact of memories on emotions, (v) understanding the impact of beliefs on emotions, and (vi) understanding the control of the expression of emotions (hiding); reflective stage (7–11 years), (vii) understanding the regulation of the experience of emotions via reflective psychological strategies, (viii) understanding the mixed nature of emotions (ambivalence), and (ix) understanding moral emotions (pride, shame, guilt) (e.g., Pons, Harris, & de Rosnay, 2004; Tenenbaum, Visscher, Pons, & Harris, 2004; Albanese, De Stasio, Di Chiacchio, Fiorilli, & Pons, 2010; Molina, Bulgarelli, Henning, & Aschersleben, 2014; Rocha et al., 2015; Tang et al., 2018).

How does emotion understanding continue to develop after adolescence? We can speculate about the impact of a person's professional occupation on this development. For example, are psychologists, psychiatrists, and social workers better at labeling emotions, understanding mixed emotions, regulating of emotion, etc., as compared to engineers or astrophysicists? Alternatively, are the sons of shoemakers always barefooted – as the saying goes? Are adults with children (often, a full-time occupation) better at recognizing emotions, especially in babies and toddlers than adults with no children? Are Rogerian psychotherapists better at recognizing the facial expression of emotions than Freudian psychoanalysts? Are car dealers better at simulating – and understanding how to simulate – emotions than somebody who works alone in an office? Are diplomats and people who have

worked in different countries better at understanding the impact of culture on the expression of emotions? These are the interesting questions yet to be answered.

Individual Differences in the Development of Emotion Understanding

Despite the existence of predictable quantitative and qualitative changes in children's Emotion Understanding, an impressive body of research has highlighted the existence of marked individual differences in its development (e.g., Pons & Harris, 2005; Repacholi & Slaughter, 2003). At least five key findings have emerged.

First, individual differences in emotion comprehension are observable very early in children's development, almost from their very first conversational interactions. For example, the quantity of utterances with emotional content varies enormously in 2-year-old children: some generate more than 25 references to emotion per hour (e.g., "naughty," "nice," "good," "sad," etc.), whereas others generate none.

Second, individual differences in children's emotion comprehension are observable throughout their development, not only in pre-school children, but also in elementary school children. For example, some children between 4 and 5 years of age have a level of emotion comprehension that is superior to other children aged between 10 and 11 years. Consequently, children's emotion comprehension development is characterized not only by important age changes (see previous section), but also by important individual differences at every age.

Third, individual differences in emotion comprehension are stable over time. Longitudinal studies over a 1-year and 3-year period have revealed great stability in these differences. For example, 2–3-year-old children who generate the fewest utterances with emotional content are also those that have the lowest level of emotion comprehension at 6 years of age. In addition, 3–4-year-old children who most readily communicate spontaneously about emotions are those who show a better comprehension of emotion a year later.

Fourth, individual differences in emotion comprehension are not the expression of a localized delay or advantage in the comprehension of one or another of the core components described above. Rather, it appears that children have a general delay or advantage across the various components of emotion comprehension.

Fifth, leaving the family environment to enter preschool between 3 and 4 years of age or elementary school between five and 6 years of age brings important social, emotional, and cognitive changes (new people, new environments, etc.). However, the transition from the family environment to pre-school and later to school does not seem to have a significant impact on the magnitude of individual differences in emotion comprehension; these transitions neither decrease nor increase such individual differences. For example, young children who have a higher than average comprehension of emotions prior to entering elementary school continue to show a higher comprehension after entering the school system.

This continuity of individual differences in Emotion Understanding as children move through various environments suggests that there may be a sensitive period during which the trajectory for the development of emotion comprehension becomes relatively stable. Does this mean that at a certain age, around 2 or 3 years of age, for example, individual differences in emotion comprehension become unalterable? At this time this question cannot be answered but given the stability of individual differences, it certainly deserves attention.

Emotional Understanding and Emotional Experience

We conclude this section by discussing the relation between children's Emotion Understanding and their emotional experience. In line with proposals about the development of consciousness by Jean Piaget, Annette Karmiloff-Smith, and Pierre Mounoud (see Pons & Harris, 2001 for a discussion), we speculate that the developmental

relationship between Emotion Understanding and emotional experience (i.e., the capacity to feel emotions, to express emotions, to control the expression of emotions, and to regulate the experience of emotions) has the shape of a spiral. At certain phases of development, Emotion Understanding precedes and directs emotional experience, while at other phases; emotional experience precedes and directs Emotion Understanding. The development of emotional competence can be described as a succession of phases: (i) in which automatic and implicit emotional experience is transformed in a top-down fashion by new deliberate and explicit insights that result in new emotional experiences that are initially voluntary and explicit and then become automatic and implicit and (ii) where old automatic and implicit emotion understanding is transformed in a bottom-up fashion by new deliberate and explicit emotional experience which results in new emotion understanding that is initially voluntary and explicit and then becomes automatic and explicit. Below, we offer some examples of this spiral relationship between Emotion Understanding and emotional experience.

Most preschoolers are able to hide their feelings and to simulate a positive emotion when receiving a disappointing gift. However, it will take them some years before they can understand and make explicit the distinction between the overt expression of emotion and the actual experience. Later in life, some of these children will become diplomats or international businessmen. They will be exposed to new cultural values and practices and learn new emotional display rules. At first, they will do so voluntarily and explicitly. However, little by little, they will be able to control automatically and implicitly their emotional expression (until they move to another country or move back to their country of origin).

Because of their temperament, some children react to frustration with anger (others with sadness). Because of the education they received from their parents or from the society, some will feel guilty about their reactions ("being angry is bad") without knowing why they feel guilty. Eventually, they may become aware of the link between feeling angry and feeling guilty. This conscious insight may not stop them from feeling guilty but it may limit the impact of that feeling and provide some sense of relief.

Most toddlers are capable of automatically regulating their feelings by means of social, behavioral, and cognitive strategies. For example, they can ask for comfort when they feel sad or scared, withdraw into their room when they feel angry, scream when fighting against another child, or re-enact an upsetting situation with their dolls, or cover the ears when scolding by parents or watching Pippi Longstocking scratching a blackboard with her nails! However, it is only later that they will understand how emotions can be regulated by means of such strategies. Later in life, they will use – at first, deliberately and then automatically – an increasing number of new strategies (especially cognitive strategies) to regulate their feelings such as "situation selection," "situation modification," "attentional deployment," "cognitive change," and "response modulation" (see Gross & Thompson, 2007, for a review of these cognitive strategies).

When people seek to understand their emotional experiences, they try to describe and explain them (their nature, causes, and consequences). These descriptions and explanations can be used to anticipate and redirect emotional experiences (e.g., "I know that when I am too stressed I feel depressed. I have to learn to say no to some of my colleagues if I do not want to become depressed"). They also contribute to a change in emotional experience by providing information about its cause (e.g., "I feel angry because I am scared. I can relax by breathing deeply"). Several studies have shown that educational and clinical interventions that aim to improve emotion understanding have a positive impact on emotional experience (see Bender, Pons, Harris, Esbjørn, & Reinholdt-Dunne, 2015 for a review).

In summary, and in line with Henri Wallon, we might say that emotion understanding both contributes to, and takes away from, an emotional experience that part of reality which is understood.

To conclude this section, we can speculate that the role of Emotion Understanding and emotional experience depends, or at least ought to depend, on the particular situation we are dealing with. In some situations, it is better to be ruled by Emotion Understanding (e.g., when taking an exam), whereas in other situations, it is better to be ruled by emotional experience (e.g., when dancing a tango). Although everybody is susceptible to guidance from both, some individuals are ruled by their Emotion Understanding, whereas others are ruled by their emotional experience. In the future, it would be interesting to investigate these two forms of guidance, from both a developmental and personality perspective.

How Can We Explain the Development of Emotion Understanding?

Recent efforts to investigate the origins of the development of children's Emotion Understanding have adopted two different approaches. Some investigators have emphasized children's early affective experiences, whereas others have emphasized cognitive variables. According to the first hypothesis, the quality of children's affective experiences, especially in relation to their primary caregiver (attachment figure), is assumed to have a major impact on Emotion Understanding. According to the second hypothesis, children's Emotion Understanding is thought to be primarily influenced by their cognitive development – including advances in linguistic competence – as well as certain features of their conversational environment, with particular emphasis on aspects of maternal discourse.

The Affective Hypothesis

The hypothesis that children's affective well-being, particularly within their family circle, facilitates their exploration, acceptance, and, ultimately, their understanding of emotions stems from research emphasizing individual differences in socio-emotional functioning (Thompson, 1999). Within this approach, the influence of children's primary attachment relationship has received particular attention because of its important role in early affective regulation. Some authors have argued that the sensitive caregiving experienced within a "secure" attachment relationship, and the quality of interactions experienced therein, facilitate children's developing understanding of mind and emotion. This can be contrasted with "insecure" attachment relationships, in which children experience inconsistent, unreliable, or insufficient support from caregivers, which, in turn, is thought to discourage children from exploring and, thus, learning about emotional experiences in their primary attachment relationship (Fonagy & Target, 1999).

Evidence can be drawn from various sources to support the assertion that children who are more securely attached have some advantage on Emotion Understanding tasks. For example, securely attached children are better able to understand the emotional implications of fictional stories when those stories contain emotionally challenging separation themes (Bretherton, Ridgeway, & Cassidy, 1990; Main, Kaplan, & Cassidy, 1985). More securely, or less insecurely, attached children are better able to understand the impact of beliefs on emotions (de Rosnay & Harris, 2002). Furthermore, children who are securely attached to their mothers at 12 months have some advantage in understanding mixed emotions at 6 years (Steele, Steele, Croft, & Fonagy, 1999). Fonagy, Target, and Gergely (2000) have also demonstrated a relationship between attachment behaviors and the capacity for representing the mental states of self and others among patients with borderline personality disorders. Finally, Laible and Thompson (1998) showed that mothers who represent their attachment with their child as secure on the Attachment Q-set have children with a better understanding of negative emotions than their insecurely attached counterparts between 2 and 6 years. Subsequent research did not replicate this finding precisely but continued to show that secure attachment was linked to superior understanding. Secure attachment has been proposed as a factor facilitating children's understanding of the link

between beliefs, desires, and emotion (Fonagy, Redfern, & Charman, 1997), as well as their understanding of situation-emotion regularities (Laible & Thompson, 1998). Others have emphasized the importance of attachment experiences for children's subjective emotional appraisal of ambiguous situations, especially when these touch on attachment issues (Main, Kaplan, & Cassidy, 1985; Shouldice & Stevenson-Hinde, 1992). The preceding literature has focused on the normal range of emotional experiences within typical families.

In contrast to the predominantly secure and organized attachment relationships experienced by children brought up in typical and well-functioning families, children who have experienced abuse are frequently characterized by insecure and disorganized attachment patterns (Cyr, Euser, Bakermans-Kranenburg, & Van Ijzendoorn, 2010). A small number of studies have shown that such distorted and insecure attachment patterns are associated with a strong negative impact on Emotion Understanding. For example, Camras, Ribordy, Hill, and Martino (1990) showed that abused children between 3 and 7 years were less accurate in recognizing certain basic emotions (e.g., happiness, sadness, anger, fear, disgust, and surprise) than non-abused children. Shipman, Zeman, Penza, and Champion (2000) found that girls who had been sexually abused by their fathers or paternal figures between 6 and 12 years had a lower level of Emotion Understanding (e.g., difficulty in understanding the causes and consequences of emotions) than girls who had not been sexually abused. Shipman and Zeman (2001) also found that children who had been physically abused between 6 and 12 years had more difficulties in understanding how to control feelings such as anger than non-abused children. In addition, mothers of abused children were less able to recognize their children's emotional displays and to understand how to help their children cope with negative emotions than mothers of non-abused children (Shipman & Zeman, 1999). Finally, Perizzolo and her colleagues (2017) showed that mothers with interpersonal violence-related posttraumatic stress disorder (IPV-PTSD) are likely to have children with impaired emotion understanding.

The Cognitive Hypothesis

The hypothesis that more advanced Emotion Understanding goes hand in hand with more advanced cognitive capacities, as well as a social environment that engenders certain ways of thinking about people as emotional agents, derives from a research tradition that focuses on cognitive development and the social context in which it occurs.

Up to a point, human beings can identify each other's thoughts and feelings by observation. They observe other people's facial expressions and bodily posture for clues to their future intentions. However, human beings (in contrast to any other species) can also talk to each other and indeed to themselves (i.e., engage in inner speech) about what they think and feel (Astington & Baird, 2005). It is likely that children's Emotion Understanding varies with their opportunities to engage in such conversation and with the level of their language for at least two reasons. First, on a functional level, language may be considered as a cognitive instrument of representation because it provides representational resources for managing emotions. Feelings can be considered as objects for language to represent in the same way as any other concrete or abstract object. Therefore, the more children are able to represent such objects, the better their understanding. Second, language may be considered as a social instrument of communication. Children with superior language skills are able to communicate more easily with other people and may be more engaged conversation partners. By implication, a "Virtuous Circle" is created in which children with greater language ability secure more opportunities for using that ability, and thereby come to represent emotional mental states more extensively. Numerous lines of evidence now support this two-step explanation of the impact of children's language on their Emotion Understanding. First, children with

advanced language skills perform better on Emotion Understanding tasks. Second, bilingual children show an advanced Emotion Understanding in comparison with their monolingual counterparts. Third, deaf children born into non-signing families have a poor Emotion Understanding. Fourth, children who are exposed to maternal conversation rich in references to mental states perform well on Emotion Understanding tasks. Fifth, language-based intervention studies produce clear gains in Emotion Understanding. Sixth, the use of cognitive and emotional mental terms by children and their families correlates positively with children's Emotion Understanding. Seventh, people with autism who display a language impairment (especially in relation to the pragmatic use of language) but not an intellectual impairment (e.g., high-functioning individuals with Asperger's syndrome) are delayed in their Emotion Understanding (see Harris, de Rosnay, & Pons, 2005 for a review).

Additional support for the cognitive hypothesis comes from research demonstrating the importance of intelligence (Albanese et al., 2010) and working memory capacity for children's understanding of emotional states (Morra, Parrella, & Camba, 2011). Finally, research with mentally retarded adults has revealed a significant, positive correlation between IQ and the understanding of mixed and moral emotions, the influence of belief on emotions, and strategies for regulating emotions (Hernández-Blasi, Pons, Escalera, & Suco, 2003).

Affect, Intellect, or Both?

The studies summarized above, together with those that stress affective experience, demonstrate relations between a child's Emotion Understanding and characteristics of the child and his or her family. As such, these studies represent a considerable advance in our understanding of the origins of children's Emotion Understanding. Nevertheless, at least one important issue emerges from these studies that requires further attention.

It is difficult to evaluate the specific and relative contribution to Emotion Understanding of factors linked to children's affective experiences on the one hand, and factors linked to children's intellectual development on the other. This situation has arisen because few studies have systematically and simultaneously examined both kinds of variables. Regarding the attachment-based research reviewed above, it is unclear whether attachment security has a direct influence on Emotion Understanding or whether attachment covaries with other aspects of the child's socio-emotional and linguistic environment that are of importance for Emotion Understanding. For example, mothers of secure children speak more coherently about their attachment relationship history (van IJzendoorn, 1995) and they use more appropriate mentalistic discourse with their children (Meins, Fernyhough, Fradley, & Tuckey, 2001).

Pons et al. (2014) tried to investigate the specific contribution of these two groups of factors. They examined the impact of abuse and learning difficulties on Emotion Understanding in older children and young adolescents. The results showed that learning difficulties but not abuse had an impact on Emotion Understanding. This finding seems to be inconsistent with some of the results quoted above showing that abuse had an impact on emotion understanding. However, there are two important caveats to these results. First, a history of abuse presents a risk for other factors, such as learning difficulties, that have an influence on emotion understanding. Learning difficulties are the norm among abused children and adolescents. We can speculate that the impact of abuse on emotion understanding is, if not mediated, at least moderated by learning difficulties. This hypothesis should be tested in the future. Second, a history of abuse may nonetheless *color* children's understanding of emotionally provocative situations even if it does not affect directly the basic understanding of the psychological and circumstantial underpinnings of emotional states: Children with a history of abuse may employ the same explanatory framework for emotion but make distorted attributions about causes, motives, and so on. In future research,

addressing the importance of affective experiences on emotion understanding (e.g., specific types of abuse, a history of trauma or attachment organization), it is crucial that careful consideration be given to cognitive factors, which could underpin emotion understanding deficits.

What Is the Impact of Emotion Understanding and How Can We Help Them to Improve Children's Emotion Understanding?

The Impact of Emotion Understanding

Emotion understanding has emerged as a helpful predictor of children's psychological well-being, pro-social competences (including empathy), and school achievement (Cuisinier, Clavel, de Rosnay & Pons, 2010; de Rosnay, Harris, & Pons, 2008; Halberstadt, Denham, & Dunsmore, 2001; Pons et al., 2015; Tornare, Czaijkowski & Pons, 2015; Viana, Zambrana, Karevold, & Pons, 2016; von Salisch, Haenel, & Denham 2015 for reviews). For example, children who understand that emotional reactions are often mixed are also children who have high self-esteem and life satisfaction and low levels of anger or behavioral problems. Children who have a good understanding of the way that emotions can be hidden from other people are also children who are more popular among their peers and teachers and better able to cooperate and resolve interpersonal conflicts. Children with a good understanding of how emotions can be regulated by means of cognitive, behavioral, and social strategies (e.g., attention deployment, cognitive appraisal, breathing exercise, social support) are at the same time children with good school achievement.

Teaching Emotion Understanding

Because of its multiple positive impacts, Emotion Understanding has become one of the main targets of an increasing number of training studies (see Baron-Cohen, Lombardo, & Tager-Flusberg, 2013; Pons et al., 2015; Pons et al., 2018; Sprung, Münch, Harris, Ebesutanid, & Hofmann, 2015 for reviews). For example, in a pioneering study, Peng, Johnson, Pollock, Glasspool, and Harris (1992) tried to teach children (4–7 years) to understand the potentially mixed nature of emotions. Only the children in the training group were coached to understand mixed emotions. For instance, after telling the children a story describing how a lost dog found its way home, but was discovered to be hurt on its return, children were asked a series of questions focusing on particular aspects of the situation confronting the story protagonist: "How does the dog's owner feel when his dog comes home?," "How does the dog's owner feel when he realizes his dog is hurt?," and "How does the dog's owner feel overall?" Results showed that only 6- and 7-year-old children from the training group improved their understanding of mixed emotions; they were better in acknowledging their existence and also better at providing examples of situations provoking such emotions. The fact that 4- and 5-year-old children in the training group did not take advantage of the coaching indicated that either the understanding of mixed emotions necessitated some prerequisites (e.g., linguistic abilities, attentional capacities) or that just asking questions was not enough to increase their understanding of mixed emotions. Hadwin, Baron-Cohen, Howlin, and Hill (1996) sought to teach the recognition of basic emotions and the understanding of the impact of situations, desires and (false) beliefs on emotions to children with autism. Only the children in the training group were taught the components of emotions that they were unable to understand during the pretest phase. For example, if children failed in understanding the impact of desires on emotions, the experimenter said after they had wrongly answered: "Thomas is happy because he sees clowns. When you do something you like, then you feel happy!" Only the children in the training group improved their Emotion Understanding, and this improvement was still evident 2 months later. Tenenbaum, Alfieri, Brooks, and Dunne (2008) found that children (5–8 years), who either explained (self-explanation condition) or listened to an

experimenter who explained (experimenter-explanation condition) the causes of characters' hidden and ambivalent emotional reactions in different vignettes, showed improvements in their understanding of emotions compared to a control group who listened to the vignettes and answered questions unrelated to emotions. Ornaghi, Brockmeier, and Gavazzi (2011) conducted a study with children (3–5 years) aimed at assessing the relationship between children's psychological lexicon and their Emotion Understanding. Only the children in the training group were read stories enriched with psychological terms and took part in language games aimed at stimulating the use of mental state terms. The results showed that children in the training group displayed stronger improvements in their understanding of emotions.

This corpus of research represents a significant advance in our knowledge about how to help typically developing and atypically developing children increase their understanding of emotions by the means of cognitive and linguistic instructional interventions in a quasi-experimental setting. However, these interventions were often conducted outside the classroom on an individual basis by third parties with a high level of expertise, e.g., an experimenter or psychotherapist. They were not classroom-based interventions conducted by the habitual teacher of the children. Moreover, these interventions sought to help children to improve their understanding of a limited number of components of emotions (rather than several components, both simple and complex). Hence, their usefulness and applicability in kindergarten and elementary school, where the teacher is likely to interact with a large and heterogeneous group of children have yet to be demonstrated.

An important contributor to the development of children's Emotion Understanding is their participation in dialogues with peers and adults (see the Cognitive hypothesis section above). Indeed, dialogue about emotions with peers and adults is likely to help children bring implicit knowledge about emotions into awareness, to engage at a higher level of reasoning and problem solving about emotions (than when they are alone), to reflect on their own emotional experiences, and to compare them with those of other people. Considering how long children spend at kindergarten and elementary school, teachers can play a key role in fostering children's Emotion Understanding. However, very few studies have examined the impact of dialogue-based interventions in the classroom. Their findings are, as we shall now see, encouraging but partial.

Pons, Harris, and Doudin (2002) evaluated the impact of an intervention called *School Matters In Lifeskills Education* (SMILE) (see Harrison & Paulin, 2000 for a description) on the understanding of several simple and complex components of emotions by 9-year-old British school children. This intervention was carried out by their habitual teacher on a daily basis for 30 min over a 3-month period (circa 30 h in total). The teacher attended a 2-week intensive training course to learn how to use the program. The SMILE focuses on children's present, past and future emotions, their nature, causes, and consequences. It encourages children to think and speak about both their own emotions and those of others (family, friends, schoolmates, etc.), whether real or imaginary. The results were encouraging. Only the children who received the SMILE improved significantly in their overall level of Emotion Understanding between the pretest and posttest (children in the control group did not change significantly). After the 3-month intervention, the level of the intervention group increased by 2 years and was equivalent to the level of 11-year-olds. However, the program did not affect the range of individual differences, which remained large and stable even after the intervention.

Giménez-Dasí, Quintanilla, Ojeda, and Lucas-Molina (2017) evaluated the impact of a new intervention called *Thinking Emotions* (see Giménez-Dasí, Fernández-Sánchez, & Daniel, 2013 for description) on the understanding of both simple and complex components of emotions by 4- and 5-year-old Spanish Roma preschoolers. This program was conducted by children's regular teachers on a weekly basis for 1 h over the course of one school year (circa 30 h in total). The teachers attended an initial 35-h

training course to learn how to use the program and were supervised twice a week throughout the year. During the same period, parents were also involved by engaging in activities at home (e.g., daily dialogues about emotions with their children). This program was designed, like the SMILE, to help children to develop their Emotion Understanding and was based on Lipman's Philosophy for Children (P4C). In this program, children develop, in interaction with their peers and through the dialogues that the teacher introduces and guides, an understanding of emotions that stem from their own interests and preoccupations. The program aims at improving the understanding of basic emotions (happiness, sadness, fear and anger), emphasizing the identification of one's own emotions and the recognition of emotions through facial expressions (including the distinction between expressed and actual emotions), reflecting on the causes and consequences of emotions, and on emotion regulation. It also promotes reflections and dialogues about more complex emotions such as pride, jealousy and ambivalence. The results showed that the *Thinking Emotions* program had a clear and significant impact on children's Emotion Understanding (Giménez-Dasí et al., 2017).

Although promising, the findings of these intervention studies should be interpreted with caution. In all the studies, the interventions were conducted by only one or two teachers. Therefore, it was not possible to evaluate the specific contribution of the teacher's pedagogical motivation and competence versus that of the intervention itself. Another challenge with these interventions is that their implementation was demanding. The teachers were highly trained (between 1 and 2 weeks) and sometimes also supervised throughout the intervention. In some studies, the parents were also involved throughout. Such training and supervision (and parental involvement) are likely to protect the quality of the intervention. However, they are likely to compromise implementation, because many kindergarten and schools do not have the resources to develop such a level of expertise in their teachers or to provide supervision throughout the intervention. The active participation of the parents throughout the intervention can also be a challenge. Some parents are likely to be more motivated than others. We currently lack a scientifically evaluated comprehensive, brief, and low-cost interventions integrated into the school curriculum for normal children conducted by their habitual teachers. Shared book reading seems to be one promising candidate for improving emotion understanding in young children (Grøver & Rydland, 2017; LaForge, Perron, Roy-Charland, Roy, & Carignanm, 2018).

Conclusion

We conclude this chapter by discussing an important, open question: how far do children acquire an understanding of emotions through, direct first-hand observation as compared to indirect mediated third-person testimony about either their own emotional experiences or the emotional experiences of third parties (mother, father, siblings, peers, fictional characters, etc.)? We postulate that there are at least two ways to understand emotions in the self and others:

- The classic Piaget-Rousseau strategy of engaging in first-hand observation: (i) the child experiences fear of a dog and identifies his emotion via self-observation (e.g., he feels his heart beating or legs trembling); (ii) the child sees his sister displaying fear of a dog and identifies her fear via his observation of her (e.g., she expresses fear on her face, tries to run away, etc.).
- The mediated strategy of learning from the testimony of other people: (iii) the child experiences fear and is helped to identify it as such by someone else's testimony (e.g. the child's mother says: "Don't be afraid – it's only a nice puppy"); (iv) the child sees his sister being approached by a dog and identifies her as feeling fear because either she or their mother provides testimony to that effect (e.g., the sister says; "I'm scared" or the mother says: "Don't be afraid - it's only a nice puppy").

These examples show that either direct first-hand observation or testimony provided by other people might play a role in the identification both of one's own emotional experiences and also those of others. Every typically developing child is likely to use both strategies. However, when the same emotional experience is identifiable through both direct first-hand observation or through the testimony of other people some children may rely on one strategy, whereas others may rely on the other. Indeed, research has shown that children rely both on first-person observation (e.g., Gopnik & Wellman, 2012; Was & Warneken, 2017) and on the testimony of other people (e.g. Harris, 2012; Palmquist, Jawal & Rutherford, 2016) when seeking information about the world (Hermansen, Ronfard, Harris, Pons & Zambrana, 2017). To the best of our knowledge, however, no research has sought to investigate the role of these two strategies in relation to emotion understanding, whether from a developmental perspective or an individual differences perspective.

Do infants and young children initially rely on direct, first-hand observation to understand emotions in the self and others or do they initially rely on the testimony of other people, especially their immediate caregivers, to understand their own emotions and those of others? Currently, it is difficult to answer this question. However, we may speculate, as we did in the section where we discussed the relation between Emotion Understanding and emotional experience, that the developmental relationship between these two strategies has the form of spiral. At certain phases of development, direct first-hand observation is the dominant strategy for understanding emotions, whereas at other phases, mediated third-person testimony is the dominant strategy.

Why might some children (adolescents and adults) prefer, at least after a certain age, direct first-hand observation to understand emotions, whereas others prefer mediated third-person testimony, especially when both strategies are equally possible and valid to understand emotions in the self and others? Taking attachment styles/status into account might provide some insight into these individual preferences. Numerous studies have been conducted on the emotional and social impact of attachment (Cassidy & Shaver, 2018). With the exception of emotion understanding, however, very little is known about the impact of attachment styles on cognitive development, even though the primary attachment figure (e.g., mother, father) is conceived by most attachment researchers and practitioners, as a secure base that the child uses to understand the world, including the emotional world (Powell, Cooper, Hoffman, & Marvin, 2013). Research has been conducted on the relation between attachment and emotion understanding in children (see the "affective" hypothesis above). However, so far, almost no research has been conducted on the impact of attachment styles on the way that children seek to understand emotional experience – be it their own observation or testimony of others. One study has addressed the impact of attachment status on children's trust in other people's testimony as compared to direct perceptual observation. Corriveau et al. (2009) showed that avoidant children tend to rely on perceptual observation, ambivalent children tend to rely on their mother's testimony, and secure children shift appropriately between these two sources of information. No study has sought to investigate whether attachment styles can explain the development and the individual differences in children's use of direct first-hand observation as compared to testimony by other people in understanding emotions.

References

Albanese, O., De Stasio, S., Di Chiacchio, C., Fiorilli, C., & Pons, F. (2010). Emotion understanding in children: Impact of age and intelligence. *The Journal of Genetic Psychology, 171*, 101–115. https://doi.org/10.1080/00221320903548084

Astington, J. W., & Baird, J. A. (2005). *Why language matters for theory of mind*. Oxford, England: Oxford University Press.

Baron-Cohen, S., Lombardo, M., & Tager-Flusberg, H. (2013). *Understanding other minds: Perspectives from developmental social neuroscience*. Oxford, UK: Oxford University Press.

Bender, P. K., Pons, F., Harris, P. L., Esbjørn, B. H., & Reinholdt-Dunne, M. L. (2015). Emotion understanding in clinically anxious children: A preliminary investigation. *Frontiers in Psychology, 6*, 1–10. https://doi.org/10.3389/fpsyg.2015.01916

Bretherton, I., Ridgeway, D., & Cassidy, J. (1990). Assessing internal working models of attachment relationship. In T. Greenberg, D. Cicchetti, & E. Cummings (Eds.), *Attachment in the preschool years* (pp. 273–308). Chicago, IL: University of Chicago Press.

Brown, A. L. (1978). Knowing when, where, and how to remember: A problem of metacognition. In R. Glaser (Ed.), *Advances in instructional psychology* (Vol. 1, pp. 77–165). Mahwah, NJ: Lawrence Erlbaum Associates.

Camras, L., Ribordy, S., Hill, J., Martino, S., Sachs, V., Spaccarelli, S., & Stefani, R. (1990). Maternal facial behavior and the recognition and production of emotional expression by maltreated and nonmaltreated children. *Developmental Psychology, 26*(2), 304–312. https://doi.org/10.1037/0012-1649.26.2.304

Cassidy, J., & Shaver, P. R. (Eds.). (2018). *Handbook of attachment: Theory, research, and clinical applications* (3rd ed.). London, England: The Guilford Press. ISBN 9781462536641.

Corriveau, K. H., Harris, P. L., Meins, E., Fernyhough, C., Arnott, B., Elliott, L., … de Rosnay, M. (2009). Young children's trust in their mother's claims: longitudinal links with attachment security in infancy. *Child Development, 80*(3), 750–761. https://doi.org/10.1111/j.1467-8624.2009.01295.x

Cuisinier, F., Clavel, C., de Rosnay, M., & Pons, F. (2010). Emotional experiences at the elementary school: Theoretical and pragmatic issues. In F. Pons, M. de Rosnay, & P.-A. Doudin (Eds.), *Emotions in research and practice* (pp. 175–202). Aalborg, Denmark: Aalborg University Press.

Cyr, C., Euser, E. M., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2010). Attachment security and disorganization in maltreating and high-risk families: A series of meta-analyses. *Development and Psychopathology, 22*(1), 87–108. https://doi.org/10.1017/S0954579409990289

de Rosnay, M., & Harris, P. L. (2002). Individual differences in children's understanding of emotion: The role of attachment and language. *Attachment & Human Development, 4*(1), 39–45. https://doi.org/10.1080/14616730210123139

de Rosnay, M., Harris, P. L., & Pons, F. (2008). Making links between emotion understanding and developmental psychopathology in young children. In C. Sharp, P. Fonagy, & I. Goodyer (Eds.), *Social cognition and developmental psychopathology* (pp. 343–385). Oxford, UK: Oxford University Press.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive developmental inquiry. *American Psychologist, 34*(10), 906–911. https://doi.org/10.1037/0003-066X.34.10.906

Fonagy, P., Redfern, S., & Charman, T. (1997). The relationship between belief-desire reasoning and a projective measure of attachment security (SAT). *British Journal of Developmental Psychology, 15*(1), 51–61. https://doi.org/10.1111/j.2044-835X.1997.tb00724.x

Fonagy, P., & Target, M. (1999). An interpersonal view of the infant. In A. Hurry (Ed.), *Psychoanalysis and developmental therapy* (pp. 3–31). Madison, CT: International University Press.

Fonagy, P., Target, M., & Gergely, G. (2000). Attachment and borderline personality disorder: A theory and some evidence. *Psychiatric Clinics of North America, 23*(1), 103–122. https://doi.org/10.1016/S0193-953X(05)70146-5

Giménez-Dasí, M., Quintanilla, L., & Daniel, M. F. (2013). Improving emotion comprehension and social skills in early childhood through philosophy for children. *Childhood & Philosophy, 9*(17), 63–89. Retrieved from https://www.researchgate.net/publication/257380307_Improving_Emotion_Comprehension_and_Social_Skills_in_Early_Childhood_through_Philosophy_for_Children

Giménez-Dasí, M., Quintanilla, L., Ojeda, V., & Lucas-Molina, B. (2017). Effects of a dialogue-based program to improve emotion knowledge in Spanish Roma preschoolers. *Infants & Young Children, 30*(1), 3–16. https://doi.org/10.1097/IYC.0000000000000086

Gopnik, A., & Wellman, H. M. (2012). Reconstructing constructivism: Causal models, Bayesian learning mechanisms, and the theory theory. *Psychological Bulletin, 138*(6), 1085–1108. https://doi.org/10.1037/a0028044

Gross, J. J., & Thompson, R. A. (2007). Emotion regulation: Conceptual foundations. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3–24). New York, NY: Guilford Press; Hadwin, J., Baron-Cohen, S., Howlin, P., & Hill, K. (1996). Can we teach children with autism to understand emotions, beliefs, or pretence? *Development and Psychopathology,* 8(2), 345–365. doi: https://doi.org/10.1017/S0954579400007136

Grøver, V. & Rydland, V. (2017). Book-based interventions support young bilinguals' narrative and perspective-taking skills. Paper presented at the International Association for the Study of Child Language (IASCL), Lyon, France, July 18, 2017.

Halberstadt, A. G., Denham, S. A., & Dunsmore, J. C. (2001). Affective social competence. *Social Development, 10*(1), 79–119. https://doi.org/10.1111/1467-9507.00150

Harris, P. L. (2012). *Trusting what you're told: How children learn from others*. Cambridge, MA: Belknap Press/Harvard University Press.

Harris, P. L., de Rosnay, M., & Pons, F. (2005). Language and children's understanding of mental states. *Current Directions in Psychological Science, 14*(2), 69–73. Retrieved from http://www.jstor.org/stable/20182991

Harris, P. L., de Rosnay, M., & Pons, F. (2016). Understanding emotion. In L. Feldman Barrett, M. Lewis, & J. Haviland-Jones (Eds.), *Handbook of emotions* (3rd ed., pp. 293–306). New York, NY: The Guilford Press. ISBN 9781462525348.

Harris, P. L., Olthof, T., & Meerum Terwogt, M. (1981). Children's knowledge of emotion. *The Journal of Child Psychology and Psychiatry, 22*(3), 247–261. https://doi.org/10.1111/j.1469-7610.1981.tb00550.x

Harrison, P., & Paulin, G. (2000). *School Matters in Lifeskills Education. A framework for PSHE and citizenship in primary schools*. Oxford: Oxford County Council, Education Science. Hernandez-Blasi, C., Pons, F., Escalera, C., & Suco, A. (2003, June). *On the role of intelligence on emotional comprehension*. Poster presented at the 33rd Annual Meeting of the Jean Piaget Society, Chicago, IL.

Hermansen, T., Ronfard, S., Harris, P.L., Pons, F. & Zambrana, I. (2017, October). Are preschoolers' questions impacted by prior inconsistent experiences during first-hand exploration? Pre-conference workshop on question asking in childhood: Development, continuity, and constraints, *Cognitive Development Society 2017 Meeting*.

LaForge, C., Perron, M., Roy-Charland A., Roy, E.M., & Carignan, I. (2018). Contributing to children's early comprehension of emotions: A picture book approach. *Canadian Journal of Education.* Manuscript in press.

Laible, D., & Thompson, R. (1998). Attachment and emotional understanding in preschool children. *Developmental Psychology, 34*(5), 1038–1045. https://doi.org/10.1037/0012-1649.34.5.1038

Main, M., Kaplan, N., & Cassidy, J. (1985). Security in infancy, childhood and adulthood: A move to the level of representation. *Monographs of the Society for Research in Child Development, 50*, 66–104.

Meins, E., Fernyhough, C., Fradley, E., & Tuckey, M. (2001). Rethinking maternal sensitivity: Mothers' comments on infants' mental processes predict security of attachment at 12 months. *Journal of Child Psychology and Psychiatry, 42*(5), 637–648. https://doi.org/10.1111/1469-7610.00759

Meyer, E. (1935). La représentation des relations spatiales chez l'enfant. *Cahiers de Pédagogie Expérimentale et de Psychologie de l 'Enfant, 8*, 1–16.

Molina, P., Bulgarelli, D., Henning, A., & Aschersleben, G. (2014). Emotion understanding: A cross-cultural comparison between Italian and German preschoolers. *European Journal of Developmental Psychology, 11*, 592–607. https://doi.org/10.1080/17405629.2014.890585

Morra, S., Parrella, I., & Camba, R. (2011). The role of working memory in the development of emotion comprehension. *British Journal of Developmental Psychology, 29*(4), 744–764. https://doi.org/10.1348/2044-835X.002006

Ornaghi, V., Brockmeier, J., & Gavazzi, I. (2011). The role of language games in children's understanding of mental states: A training study. *Journal of Cognition and Development, 12*, 239–259. https://doi.org/10.1080/15248372.2011.563487

Palmquist, C. M., Jaswal, V. K., & Rutherford, A. (2016). Success inhibits preschoolers' ability to establish selective trust. *Journal of Experimental Child Psychology, 152*, 192–204.

Pascal, B. (1662). Preuve de la religion par le peuple juif, les prophéties et quelques discours.

Peng, M., Johnson, C., Pollock, J., Glasspool, R., & Harris, P. L. (1992). Training young children to acknowledge mixed emotions. *Cognition and Emotion, 6*(5), 387–401. https://doi.org/10.1080/02699939208409693

Perizzolo, V., Puro, C., Vital, M., Arnautovic, E., Torrisi, E., Pons, F., … Schechter, D. (2017, September). Emotional face matching task in IPV-PTSD mothers and non-PTSD controls, and their children: Its relationship with the Test of Emotion Comprehension (TEC). In *Poster, NCCR SYNAPSY – 7th Site Visit of the Review Panel*. Geneva, Switzerland: University of Geneva.

Piaget, J. (1974). *La Prise de Conscience*. Paris, France: Presses Universitaires de France.

Piaget, J., & Inhelder, B. (1948). *The child's conception of space*. London, UK: Routledge & Kegan.

Pons, F., Bernaschina, F., Harris, P., & Fiske, A. (2018). *Emotion understanding in Fon children*. Manuscript submitted for publication.

Pons, F., de Rosnay, M., Bender, P., Doudin, P.-A., Harris, P. L., & Gimenez-Dasi, M. (2014). The impact of abuse and learning difficulties on emotion understanding in late childhood and early adolescence. *Journal of Genetic Psychology, 175*(4), 301–317. https://doi.org/10.1080/00221325.2014.903224

Pons, F., Gimenez-Dasi, M., Daniel, M.-F., Auriac-Slusarczyk, E., Businaro, N., & Viana, K. (2018*). Impact of a low-cost classroom dialogue-based intervention on preschool children's emotion understanding.* Manuscript under revision.

Pons, F., Giménez-Dasí, M., Sala, N., Molina, P., Tornare, E., & Gamskjær, B. A. (2015). Compréhension et régulation des émotions à l'école. In M. Crahay & M. Dutrevis (Eds.), *Psychologie des apprentissages scolaires* (pp. 115–142). De Boeck Superieur. ISBN 9782807300040.

Pons, F., & Harris, P. L. (2000). *Test of emotion comprehension (TEC)*. Oxford, UK: Oxford University.

Pons, F., & Harris, P. L. (2001). Piaget's conception of the development of consciousness: An Examination of two hypotheses. *Human Development, 44*(4), 220–227. https://doi.org/10.1159/000057061

Pons, F., & Harris, P. L. (2005). Longitudinal change and longitudinal stability of individual differences in children's emotion understanding. *Cognition and Emotion, 19*(8), 1158–1174. https://doi.org/10.1080/02699930500282108

Pons, F., Harris, P. L., & de Rosnay, M. (2004). Emotion comprehension between 3 and 11years: Developmental periods and hierarchical organization. *European Journal of Developmental Psychology, 1*(2), 127–152. https://doi.org/10.1080/17405620344000022

Pons, F., Harris, P. L., & Doudin, P. A. (2002). Teaching emotion understanding. *European Journal of Psychology of Education, 17*(3), 293–304. https://doi.org/10.1007/BF03173538

Pons, F., Harris, P. L., & de Rosnay, M. (2012). Piaget and consciousness: Retrospect and prospect. In Jaan Valisiner (Ed.), History and theory of psychology (pp. 95–122). Transaction Publishers.

Powell, B., Cooper, G., Hoffman, K., & Marvin, B. (2013). *The circle of security intervention: Enhancing attachment in early parent-child relationships*. New York, NY: Guilford Press.

Repacholi, B., & Slaughter, V. (2003). *Individual differences in theory of mind: Implications for typical and atypical development*. New York, NY: Psychology Press.

Rocha, A., Roazzi, A., Da Silva, A., Candeias, A., Minervino, C., Roazzi, M., & Pons, F. (2015). Test of emotion comprehension: Exploring the underlying structure through Confirmatory Factor Analysis and Similarity Structure Analysis. In A. Roazzi, B. Campello, & W. Bilsky (Eds.), *Facet Theory: Searching for structure in complex social, cultural and psychological phenomena* (pp. 66–84). Recife, Brazil: Editora UFPE.

Shipman, K., & Zeman, J. (1999). Emotional understanding: A comparison of physically maltreating and nonmaltreating mother-child dyads. *Journal of Clinical Child Psychology, 28*(3), 407–417. https://doi.org/10.1207/S15374424jccp280313

Shipman, K., & Zeman, J. (2001). Socialization of children's emotion regulation in mother-child dyads: A developmental psychopathology perspective. *Development and Psychopathology, 13*(2), 317–336. https://doi.org/10.1017/S0954579401002073

Shipman, K., Zeman, J., Penza, S., & Champion, K. (2000). Emotion management skills in sexually maltreated and nonmaltreated girls: A developmental psychopathology perspective. *Development and Psychopathology, 12*(1), 47–62. https://doi.org/10.1017/S0954579400001036

Shouldice, A., & Stevenson-Hinde, J. (1992). Coping with security distress: The separation anxiety test and attachment classification at 4.5 years. *Journal of Child Psychology and Psychiatry, 33*(2), 331–348. https://doi.org/10.1111/j.1469-7610.1992.tb00870.x

Sprung, M., Münch, H. M., Harris, P. L., Ebesutanid, C., & Hofmann, S. G. (2015). Children's emotion understanding: A meta-analysis of training studies. *Developmental Review, 37*, 41–65. https://doi.org/10.1016/j.dr.2015.05.001

Steele, H., Steele, M., Croft, C., & Fonagy, P. (1999). Infant-mother attachment at one year predicts children's understanding of mixed emotions at six years. *Social Development, 8*, 161–178. https://doi.org/10.1111/1467-9507.00089

Tang, Y., Harris, P. L., Pons, F., Zou, H., Zhang, W., & Xu, Q. (2018). The understanding of emotion among young Chinese children. *International Journal of Behavioral Development, 42*(5), 512–517. https://doi.org/10.1177/0165025417741366

Tenenbaum, H., Visscher, P., Pons, F., & Harris, P. L. (2004). Emotion understanding in Quechua children from an agro-pastoralist village. *International Journal of Behavioral Development, 28*(5), 471–478. https://doi.org/10.1080/01650250444000225

Tenenbaum, H. R., Alfieri, L., Brooks, P. J., & Dunne, G. (2008). The effects of explanatory conversations on children's emotion understanding. *British Journal of Developmental Psychology, 26*, 249–263. https://doi.org/10.1348/026151007X231057

Thompson, R. A. (1999). Early attachment and later development. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (pp. 265–286). London, England: Guilford Press.

Tornare, E., Czajkowski, N. O., & Pons, F. (2015). Children's emotions in math problem solving situations: Contribution of self-concept, metacognitive experiences and performance. *Learning and Instruction, 39*, 88–96.

Van IJzendoorn, M. H. (1995). Adult attachment representations, parental responsiveness, and infant attachment: A meta-analysis on the predictive validity of the adult attachment interview. *Psychological Bulletin, 117*(3), 387–403. https://doi.org/10.1037/0033-2909.117.3.387

Viana, K. M. P., Zambrana, I. M., Karevold, E. B., & Pons, F. (2016). Beyond conceptual knowledge: The impact of children's theory-of-mind on dyadic spatial tasks. *Frontiers in Psychology, 7*, 1–11. https://doi.org/10.3389/fpsyg.2016.01635

Von Salisch, M., Haenel, M., & Denham, S. (2015). Self-regulation, language skills, and emotion knowledge in young children from northern Germany. *Early Education and Development, 26*, 792–806. https://doi.org/10.1080/10409289.2015.994465

Was, A., & Warneken, F. (2017). Proactive help-seeking: Preschoolers know when they need help, but do not always ask for it. *Cognitive Development, 43*, 91–105. https://doi.org/10.1016/j.cogdev.2017.02.010

Wellman, H. M. (2014). *Making minds: How theory of mind develops*. Oxford, UK: University Press.

The Role of Language in Emotional Development

Holly Shablack and Kristen A. Lindquist

Abstract

Much literature suggests a link between language and emotions. Parents' language use is linked to children's later emotion perception and understanding. Perhaps most compellingly, access to emotion words shapes which emotion someone sees on another's face. In this chapter, we outline a developmental perspective on the role of language in emotion perception, whereby language is a mechanism for acquiring and using emotion concept knowledge to make meaning of others' and perhaps one's own emotional states across the life span. We begin by discussing language and emotion understanding in preverbal infants, who without language perceive emotional facial expressions in terms of the more basic dimension of valence. Next, we discuss how language acquisition throughout toddlerhood and early childhood leads to increased emotion understanding and more nuanced emotion perception. We continue to trace the relationship of language and emotion throughout adolescence and into adulthood, documenting that disorders of aging that impair language also impair emotion perception. We close by speculating on the role of emotion words in the context of emotion experience, emotion regulation, and cross-cultural differences in emotions.

It is clear that emotions change across development. As evidenced by the other chapters in this volume, what remains in question is which aspects of emotions develop over time, when, and how. In this chapter, we discuss the role of language in emotion development. From some theoretical perspectives on emotion, the role of language in emotion should be trivial. For instance, basic emotion views assume that specific emotion categories are largely biologically endowed; in this view, infants are born with the ability to experience, express, and perceive in other categories such as anger, disgust, fear, etc. The words used to name these categories should thus have no influence on how the categories themselves are experienced or perceived (Ekman, 1992; Ekman & Cordaro, 2011; Izard, 1971, 1994, 2007). As a case in point, Ekman and Cordaro (2011, p. 369) state, "Language and emotion are independent of each other; both can evolve independently without the presence of the other…Language is socially constructed; basic emotions are not."

Yet many other psychological models of emotion assume that there is an effect of language on

H. Shablack · K. A. Lindquist (✉)
University of North Carolina—Chapel Hill, Department of Psychology and Neuroscience, Chapel Hill, NC, USA
e-mail: Kristen.lindquist@unc.edu

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_18

emotions across development. Some approaches focus on the role of language as parents transmit knowledge about emotion categories to their children through verbal discourse (Dickson, Fogel, & Messinger, 1998; Dunsmore & Halberstadt, 1997; Ereky-Stevens, 2008; Fivush, Brotman, Buckner, & Goodman, 2000; Fivush, Haden, & Reese, 2006; Fogel et al., 1992; Halberstadt, Denham, & Dunsmore, 2001; Halberstadt & Eaton, 2002; Halberstadt & Lozada, 2011; McElwain, Halberstadt, & Volling, 2007; Perlman, Camras, & Pelphrey, 2008; Saarni, Campos, Camras, & Witherington, 2006; Sullivan, Carmody, & Lewis, 2010).

Other work views language as an important mechanism in emotion. Some models focus on how children's general language ability (Pons, Lawson, Harris, & De Rosnay, 2003; Ridgeway, Waters, & Kuczaj, 1985) or culture (Tsai, Louie, Chen, & Uchida, 2007; Vinden, 1999) is a mechanism for emotion perception abilities or emotional understanding (Widen, 2013). Our own work on the psychological and neural basis of emotions hypothesizes that words for emotion categories are a crucial mechanism in both perception of emotions on others' faces and bodies (e.g., Doyle & Lindquist, 2018; Gendron, Lindquist, Barsalou, & Barrett, 2012; Lindquist, 2013, 2017; Lindquist, Barrett, Bliss-Moreau, & Russell, 2006; Lindquist, Gendron, Barrett, & Dickerson, 2014; Lindquist, MacCormack, & Shablack, 2015) and the experiences of emotions in one's own body (e.g., Lee, Lindquist, & Payne, 2018; Lindquist & Barrett, 2008a; MacCormack & Lindquist, in press). This theoretical perspective, called psychological constructionism, hypothesizes that the words that name emotion concepts ("anger," "fear," "sadness," etc.) help individuals to acquire knowledge about culturally relevant emotion categories. Words, and the concepts they name, then in turn help individuals to make meaning of—or "construct"— experiences of emotions in one's own body or perceptions of emotions in others' facial expressions. In this view, language serves as a conceptual cue in emotion, by cohering together the internal cache of knowledge associated with a set of features (facial configurations, body postures, physiological states, situations) for a particular instance of an emotion category (see Lindquist et al. 2015a). This view hypothesizes a particular developmental trajectory, in which people learn to disambiguate the meaning of their culture's emotion categories across infancy and early childhood as words naming emotion concepts are acquired; these words then continue to help people to access and use emotion concept knowledge to make meaning of others' and their own states into adolescence and adulthood (see Lindquist et al. 2015a). In this chapter, we evaluate whether the existing data is supportive of this developmental trajectory.

We begin our chapter by outlining the psychological constructionist predictions that language is a mechanism of emotion perception and understanding across development. We then turn to evidence documenting a role of language in emotion perception and understanding from infancy to late adulthood. Specifically, we show that preverbal infants do not perceive facial expressions in terms of discrete categories, but rather in terms of more basic affective dimensions of psychological meaning such as valence and arousal. We next discuss evidence documenting the emergence of discrete emotion perception and understanding as young children acquire emotion words. We trace the relationship between language and emotion through adolescence and then focus briefly on the causal evidence in adults showing that when language is well established, impaired access to emotion words via experimental manipulation or disease makes participants revert to the perception of very general affective states. Throughout, we highlight the fact that greater proficiency at perceiving emotions in others, and greater understanding of what different emotion concepts entail, is linked to a host of beneficial outcomes, including increased subjective well-being, better emotion regulation (Kashdan, Barrett, & McKnight, 2015; Lindquist & Barrett, 2008b), greater prosocial behavior (Eggum et al., 2011), higher educational attainment, and improved work relationships and productivity (Brackett, Rivers, Reyes, & Salovey, 2012; Hagelskamp, Brackett, Rivers, & Salovey, 2013). It is thus important to understand the role language plays in emotions for both mechanistic and applied reasons.

Definitions and Focus

Before we begin, it is important to clarify the constructs we will be discussing, as these are often used differently across fields and subfields. We mostly focus herein on research examining the role of language in emotion perception and emotion understanding. "Emotion perception" refers to the ability to infer the emotional meaning of another's nonverbal behaviors. This research often uses methods that rely on sensory perception (e.g., vision), and we focus exclusively on studies of visual facial perception for two reasons. First, the face has long been considered an important channel of emotion expression, and there is a long theoretical history of examining perception of emotion in the face (Ekman, 1972; Fridlund, 1991, 1994; Izard, 1971). Second, perception of emotion in faces is most frequently examined in infancy and early childhood of normal healthy aging children. As such, we do not review the relatively smaller literature using other singular channels of expression (e.g., body postures, voice; Atkinson, Dittrich, Gemmell, & Young, 2004; Aviezer, Trope, & Todorov, 2012; Grossmann, 2010; Mondloch, 2012; Walker-Andrews, 1997) or multimodal channels of expression (combinations of vocalizations, vocal prosody, body posture, scenarios, etc.; see Flom & Bahrick, 2007; Grossmann, 2010; Walker-Andrews, 1997). Our interpretations of the studies on facial emotion perception extend to these other modalities, however.

"Emotion understanding" is a broader construct and refers to the ability to understand the causes and consequences of one's own and others' emotions, the ability to identify the emotions of characters in stories, or the ability to predict what emotion someone would feel in a given scenario (see Eggum et al., 2011; Grazzani, Ornaghi, Conte, Pepe, & Caprin, 2018; Lane, Wellman, Olson, LaBounty, & Kerr, 2010; Pons, Harris, & de Rosnay, 2004). Emotion understanding is what we sometimes call "conceptual knowledge" about emotions (Lindquist et al., 2015a; Lindquist & Barrett, 2008b), and using this knowledge is a key facet of emotional complexity (Lindquist & Barrett, 2008b) and emotional intelligence (Mayer, Salovey, & Caruso, 2008; Mayer, Salovey, Caruso, & Sitarenios, 2001). This research often uses methods that rely on images of facial expressions, verbal scenarios or videos, or images of facial expressions.

In contrast to emotion perception and understanding, "emotional experience" and "emotion expression" are terms used to describe the emotional feelings one has in their own body and how that person expresses those feelings in their face, voice, body posture, or behavior. Although our constructionist view hypothesizes that words for emotion categories (e.g., "anger" vs. "fear") help people to disambiguate and thus experience as discrete the meaning of their own internal states (Lindquist, Gendron, & Satpute, 2016; Lindquist, Satpute, & Gendron, 2015b), we do not focus on this work herein for two reasons. First, too little empirical work addresses the role of language in emotional experience or expression across the life span. To our knowledge, the only research assessing the role of language in emotion experience does so in adults (Brooks et al., 2017; Kassam & Mendes, 2013; Kirkland & Cunningham, 2012; Lieberman et al., 2007; Lieberman, Inagaki, Tabibnia, & Crockett, 2011; Lindquist & Barrett, 2008a; Niles, Craske, Lieberman, & Hur, 2015; Satpute et al., 2015; Satpute, Shu, Weber, Roy, & Ochsner, 2013). There is thus no way at present to comprehensively review the cross-sectional role of language in emotional experience across development. Second, at present it is empirically challenging to manipulate and measure the role of language in emotional experiences in very young individuals. In the realm of emotion perception, it is possible to objectively measure whether a preverbal infant or a child acquiring language perceives two facial expressions as similar; there is no comparable test for whether they experience the same emotion in response to two images or scenarios. There are at present no objective physiological (e.g., anger vs. disgust; Barrett,

2006; Mauss & Robinson, 2009; Siegel et al., 2018) nor behavioral (Baumeister, Vohs, DeWall, & Zhang, 2007; Chester et al., 2016) measurements of whether an individual is experiencing one specific emotional state over another. Studies of emotion expression in children do not find clear differentiation between the facial expressions produced in one emotional situation vs. another (Camras et al., 2007; Saarni et al., 2006), suggesting that children's outward expressions alone cannot be used as an objective index of their state (this method is also likely problematic in adults; see Bogart & Matsumoto, 2010; Lindquist & Gendron, 2013; Matsumoto, 1987, 1993; Matsumoto & Kupperbusch, 2001) Finally, although research increasingly asks young children to self-report their emotions (e.g., Nook et al. 2017), self-report is either impossible or very limited in very young children, preverbal infants, or individuals with verbal impairments due to disorders of aging. Given these methodological caveats, we focus our attention on studies that convincingly document a role of language in emotion perception and understanding across the life span. We review the evidence for the role of language in emotion experience when that evidence is available.

Throughout our review, we focus almost exclusively on normative development and do not focus on how language deficits in developmental disorders (e.g., autism) may impact emotion understanding, although this is certainly an important topic of inquiry. We also focus exclusively on semantics (i.e., word meaning) in verbal or written language, although we recognize that there are many aspects of language that may impact emotion (e.g., syntax; see Majid, 2012 for a review). Finally, we do not review research explicitly examining how children learn to associate specific emotions with specific words (e.g., Shablack, Lindquist, & Becker, under review), although this type of work represents a necessary next step in an understanding of the role of language in emotion perception and understanding.

A Psychologist Constructionist Approach to Emotional Development: The Trajectory from General Affective States to Specific Discrete Emotions

The psychological constructionist approach hypothesizes a particular developmental trajectory, in which people learn to disambiguate the meaning of their culture's emotion categories across infancy and early childhood as words naming emotion concepts are acquired. These words then continue to help people to access and use emotion concept knowledge to make meaning of others' and their own states into adolescence and adulthood. According to the psychological constructionist approach to emotions (Barrett, 2006, 2013; Clore & Ortony, 2008; Cunningham, Dunfield, & Stillman, 2013; Russell, 2003), infants are not born being able to experience and perceive in others a set of discrete emotion categories such as "anger," "disgust," "fear," and so on (Bridges, 1932; Camras & Shutter, 2010; Nelson, 1987; Widen, 2013). Instead, young infants experience and perceive in others very general core affective states. Core affect refers to the general physiological state of an individual that is constituted of valence (positive or negative) and arousal (level of activation or alertness) (Barrett & Bliss-Moreau, 2009; Russell, 2003). The psychological constructionist view predicts that infants and children develop the ability to further differentiate and refine those states into more specific discrete emotions over the course of development as they acquire the ability to make situated meaning of core affect. Critically, the latter process relies on conceptual knowledge about emotions (Barrett, 2009, 2014; Clore & Ortony, 2013; Cunningham et al., 2013; Lindquist, 2013, Lindquist et al., 2015a). Conceptual knowledge refers to the cache of information (i.e., representations of the facial configurations, body postures, physiological states, situations, etc.) an individual has about specific emotion categories (for review, Lindquist et al., 2015a). For example, a child's knowledge of perceiving sadness in someone may include

crying, a quivering lip, slouched shoulders, and a preceding set of events (such as having a toy take away). A child is thought to draw on this knowledge in the moment to differentiate a negative expression (e.g., a quivering lip) as an instance of sadness vs. anger (Barrett, 2012).

Importantly, psychological constructionism posits that language plays a mechanistic role in the acquisition and use of this conceptual knowledge, as words serve as a way to cohere together the array of multimodal information that is associated with each discrete emotion category. In this sense, words are "essence placeholders" for abstract concepts (see Lindquist et al., 2015a; Lupyan, 2012; Xu, 2002) and help to access and use conceptual knowledge in an online fashion (Lupyan, 2012) to make meaning of ongoing core affective perceptions (Doyle & Lindquist, 2018) and experiences (Lindquist & Barrett, 2008a). The psychological constructionist approach thus predicts a specific developmental trajectory, whereby the development of emotion words co-occurs with children's ability to understand general affective states vs. specific discrete emotions. Although causal research for the role of language in emotion is presently limited to work with adults (Doyle & Lindquist, 2018; Fugate, Gendron, Satoshi, & Barrett, 2017; Gendron et al., 2012; Lindquist et al., 2006; Roberson & Davidoff, 2000; Roberson, Davidoff, & Braisby, 1999), the correlational evidence documenting a connection between language and emotion across the life span (e.g., Labouvie-Vief, DeVoe, & Bulka, 1989; Nook, Sasse, Lambert, McLaughlin, & Somerville, 2017; Widen, 2013) is consistent with this psychological constructionist view. We review this evidence, beginning with evidence showing that in the absence of language, preverbal infants perceive emotions in terms of the broad dimensions of valence and arousal, but not discrete emotion categories (for a similar view, see Ruba & Repacholi, forthcoming).

Preverbal Infants Perceive Valence and Arousal, Not Discrete Emotions

If language is necessary for discrete emotion perception, then it follows that preverbal infants should not perceive discrete emotions on faces. Early work on emotion perception in preverbal infants was largely interpreted as evidence that emotion categories are innate (Izard, 1971, 1994; Izard & Malatesta, 1987). In this view, language is epiphenomenal to the understanding of emotions (see Ekman & Cordaro, 2011; Izard, 2007). Despite continued interpretation of the data as evidence for discrete emotion perception (e.g., Izard, 2007), others have called into question the idea that infants perceive discrete emotions on faces (Balaban, 1995; Caron, Caron, & Myers, 1985; Widen, 2013; Widen & Russell, 2008a). It is beyond the scope of this chapter to review the entire literature on emotion perception in infancy and early childhood (see Bullock & Russell, 1986; Camras & Shutter, 2010; Grossmann, 2010; Nelson, 1987; Quinn et al., 2011; Slater, 2002; Tronick, 1989; Widen, 2013; Widen & Russell, 2008c), but we briefly examine this literature with an eye toward whether the findings clearly support perception of discrete emotion or more basic features of emotion categories such as valence and arousal.

Two things are immediately clear when reviewing the literature on perception of facial expressions in neonates and infants. The first is that neonates and young infants respond to and are interested in emotional facial muscle movements. What remains unclear is whether they understand the discrete emotional meaning of facial expressions. This uncertainty is in part due to a second fact observed in the literature—that most studies do not provide conditions that allow for strong inference about discrete emotion perception. Rather, most studies are designed in a manner that only permits inference about whether infants can differentiate basic perceptual features of faces or, at most, draw a psychological inference about the valenced or aroused meaning of a set of facial muscle movements.

The research on emotion perception with neonates is limited, but what is clear is that neonates and infants mimic mouth movements and tongue protrusions (Field et al., 1983; Field, Woodson, Greenberg, & Cohen, 1982; Haith, Bergman, & Moore, 1977; Meltzoff & Moore, 1977); focus on areas of the face that are diagnostic of social interactions, such as the nose, mouth, and eyes

(Caron et al., 1985; Haith et al., 1977; Kestenbaum & Nelson, 1990); and with age begin to predominantly focus on the eyes of faces (Haith et al., 1977; Maurer & Salapatek, 1976). The literature on infants finds that infants also clearly prefer faces that are smiling (Kuchuk, Vibbert, & Bornstein, 1986), and this preference in turn influences their ability to recognize facial identities (Bornstein & Arterberry, 2003; Turati, Montirosso, Brenna, Ferrara, & Borgatti, 2011). Although these findings are often alluded to as evidence that neonates can perceive "emotions" on faces (Field et al., 1983, 1982; Haith et al., 1977; Maurer & Salapatek, 1976; Meltzoff & Moore, 1977; Slater, 2002), they do not explicitly test the hypothesis that infants differentiate between different discrete emotion categories.

To test the hypothesis that infants can differentiate between different discrete emotion categories, studies typically use behavioral methods. These methods tend to include preferential looking paradigms, paired comparisons, familiarization and habituation, and social referencing tasks (see, de Haan & Nelson, 1998 for task descriptions). Many of these tasks rely on how long an infant looks at a specific stimulus, which comes with a set of important caveats (Oakes, 2010). Longer looking times are considered evidence that the infant views the stimulus as something novel and, correspondingly, distinct from other stimuli. Using this methodological framework, many studies suggest that infants are able to distinguish between discrete emotional expressions; however a closer look at the data shows that most studies cannot conclude discrete emotion perception is taking place.

A first issue is that many studies examine emotion perception by exclusively comparing two cross-valence emotions that differ in the broad dimension of valence (i.e., a positive valence face such as happiness vs. a negative valence face such as anger or fear). The overwhelming evidence suggests that past a certain age, infants can generally differentiate between pleasant and unpleasant facial expressions. The ability to perceive valence on faces is consistent with the psychological constructionist view but unfortunately cannot speak to whether infants perceive discrete emotions on faces. For instance, in habituation tasks, infants consistently discriminate between happy and other negative faces. By 3 months (Barrera & Maurer, 1981; Young-Browne, Rosenfeld, & Horowitz, 1977) and 5 months (D'Entremont & Muir, 1997), infants can differentiate between happy and sad faces. By 4 to 9 months (Serrano, Iglesias, & Loeches, 1995), infants differentiate between happy and angry expressions. A study looking at blink latencies, wherein larger and faster eye blinks are associated with startle responses to unpleasant and high arousal images, finds that 5-month-old infants exhibit larger blinks when an angry face is paired with a loud noise than when happy or neutral faces are paired with loud noises (Balaban, 1995).

In contrast to infants' ability to differentiate happy from angry and sad faces, there is relatively less evidence that infants can easily differentiate happy and fearful faces. What seems clear is that infants are interested in the eyes of faces in general, and posed fearful faces tend to have particularly salient eyes (Adolphs et al., 2005; Gosselin & Schyns, 2001). Infants' attention is particularly drawn to faces with wide eyes, but this does not appear to be a bias toward posed fear because infants attend to wide eyes regardless of whether the rest of the face portrays fearful or neutral affect (Peltola, Leppänen, Mäki, & Hietanen, 2009). Interestingly, the tendency to attend to the eyes of a face might be further moderated by culture. East Asian infants, like East Asian adults (Jack, Blais, Scheepers, Schyns, & Caldara, 2009; Jack, Garrod, Yu, Caldara, & Schyns, 2012), focus significantly more on the eyes of faces than do Western infants (Geangu et al., 2016).

Infants' interest in faces with wide eyes might be driven by novelty or uncertainty. In adults, the amygdala—a brain region associated with uncertainty and salience (Cunningham & Brosch, 2012; Whalen, 2007)—activates strongly to the presence of wide eyes in facial expressions (Whalen et al., 2004), and adults report seeing the types of posed fearful faces used in studies very infrequently in ecologically valid settings (see Somerville & Whalen, 2006 for evidence that fearful faces are very infrequently seen).

Habituation studies in infants are consistent with the hypothesis that fearful faces may be particularly novel or unusual to infants. These studies show some evidence for differentiation of happy and fearful faces but are plagued by order effects that suggest that infants might be attending longer to less frequently seen fearful faces. For example, 7- and 8-month-old infants show longer looking times to fearful faces but only when habituated with happy faces and not vice versa (Ludemann & Nelson, 1988; Nelson & Dolgin, 1985; Nelson, Morse, & Leavitt, 1979). These findings may show that infants can distinguish between very familiar faces (happy faces) and more unusual faces (fearful faces) but not that infants necessarily understand the psychological meaning of fearful facial expressions. A separate study found differentiation of fearful and happy faces (Geangu et al., 2016) but is also consistent with the idea that infants are preferentially focusing on highly novel or unusual facial muscle movements. Seven-month-old infants across all cultural backgrounds looked at fearful faces longer than happy faces; in this study they discriminated between happy and fearful expressions regardless of which expression was habituated. However, the amount of looking time for fearful faces was significantly reduced when infants viewed their own race fearful faces as opposed to other-race fearful faces (Geangu et al., 2016). If fear is truly serving a group-signaling role, then it would be more adaptive for infants to attend to fearful faces from their social group than an outgroup. Instead, these findings are consistent with the idea that infant looking is driven by novelty, not discrete emotion perception.

As these findings suggest, a major critique of familiarization and habituation paradigms concerns whether they give evidence of categorical perception or whether findings are driven by infants' attention to a more basic perceptual or meaning dimension that covaries with posed stimulus categories. That is, infants may be able to distinguish between perceptual differences in faces (e.g., smiling vs. frowning faces) but may not do so in a manner that indicates an understanding of the discrete emotional meaning of those perceptual differences. Categorical perception occurs when an object is classified as the same category as another object. It is a psychological phenomenon in which within-category differences become perceptually minimized and between-category differences become perceptually emphasized (see Fugate, 2013 for a discussion of categorical perception in emotion). A classic study demonstrated that infants' perceptions of facial expressions might be driven more by attention to perceptual differences than the categorical perception of emotion. Caron, Caron, and Meyers (1985) showed that 4-, 6-, and 7-month-old infants do not perceive angry and happy faces categorically but that the appearance of differentiation between emotion categories is driven by infants' attention to the presence of teeth in facial expressions. When stimuli are matched for the presence of teeth (i.e., infants see toothy grins, non-toothy grins, and toothy scowls), infants differentiate between different types of happy faces (toothy grins vs. non-toothy grins) but not between happy and angry faces that are matched for toothiness (toothy grins vs. toothy scowls). This pattern has been since replicated (Kestenbaum & Nelson, 1990).

Thus, a gold standard for demonstrating categorical perception is to demonstrate both within-category equivalence (i.e., seeing both toothy and non-toothy grins as similar) and between-category discrimination (i.e., seeing toothy grins and toothy scowls as different) in perception (see Fugate, 2013; Goldstone, 1994). In adults, categorical perception is established by using two paired studies. A first study is typically conducted to identify the categorical boundary (when a stimulus is no longer perceived to be part of one category and is now perceived to be part of another). Following the categorical boundary identification, individuals complete a discrimination test wherein they are presented with a series of stimuli that are different morphed combinations of the categories of interest. For example, participants may be presented with a morph that is a 40% fearful expression and 60% happy expression and told to indicate if the face matches face A (a 100% fearful expression) or face B (a 100% happy expression). Evidence that a 70% fearful, 30% happy face is perceived to be more

similar to a 90% fearful, 10% happy face than a face at the category boundary such as a 50% fearful, 50% happy face is suggestive that participants see stimuli that are equal steps along a perceptual gradient as categorically different from one another.

Very few studies have explicitly examined categorical perception in infants, likely due to the difficulties associated with experimentally documenting it. One study adapted the categorical perception paradigm for infant facial emotion perception using fearful and happy expressions (Kotsoni, de Haan, & Johnson, 2001). Infants were familiarized to a facial expression (e.g., a 40% fearful, 60% happy face), followed by a discrimination phase in which they were presented two times with the familiarized face: (1) a face on the other side of the category boundary (e.g., an 80% fearful, 20% happy face) and (2) a face within the same category boundary (e.g., a 20% fearful, 80% happy face). No significant differences were seen in looking time for faces within the category boundary; however, when looking at the cross-category boundary test trials, infants looked significantly longer at the novel expression when they were familiarized to the happy expressions (i.e., 40% fearful, 60% happy), but not the fearful expressions (e.g., 40% happy, 60% fear). It has been argued that this provides evidence of specific categorical perception of fear vs. happy faces; however, similar to Nelson et al. (1979), and Nelson and Dolgin (1985), infants only responded to the novel expression when it was fearful, indicating possible order effects. Regardless, the findings at best show evidence that infants can differentiate a positive face (happy) from a negative face (fear).

To truly show evidence for discrete emotion perception, studies would have to demonstrate categorical perception between faces portraying multiple discrete emotion categories, especially those that are matched in terms of the underlying dimensions of valence or arousal. One study found that infants as young as 3 months could discriminate surprise from happy and sad expressions—but only when fear, anger, and disgust expressions were not present. Once fear, anger, and disgust expressions were included, infants were no longer able to differentiate surprise expressions from the others (Young-Browne et al., 1977). One interpretation is that infants were differentiating surprised and happy/sad faces on the basis of either the presence of wide eyes or the underlying dimension of arousal, as surprise is a highly aroused emotion and happy and sad are not. To control for the role of wide eyes or the arousal level of a facial expression, studies could assess differentiation of surprise vs. fear; yet, those that have done so again yield order effects. Infants discriminate between surprised and fearful faces, but only when habituated to fear and tested with surprise (Schwartz, Izard, & Ansul, 1985). An added confound is the fact that adults often see surprised faces as ambivalent, signaling positive valence in some contexts and negative in others (Kim et al., 2004; Kim, Somerville, Johnstone, Alexander, & Whalen, 2003; Neta & Whalen, 2010). Thus, differentiation of surprise and fear may in fact be further evidence of valence differentiation.

A handful of habituation studies that control for confounding factors between emotion categories such as valence and arousal exist (Caron, Caron, & Myers, 1982; Ludemann & Nelson, 1988; Serrano, Iglesias, & Loeches, 1992; Young-Browne et al., 1977). However, these studies do not tend to find consistent and clear evidence for specific discrete emotion perception. For instance, 5-month-old infants were unable to discriminate anger when it was a novel expression in a paired comparison task of fear and sadness (Schwartz et al., 1985). Montague and Walker-Andrews (2001) found variation in infants' fixation times on facial expressions of sad, angry, or fearful expressions in a peekaboo task; however, the trends are inconsistent across emotion categories and may indicate that infants were paying attention to differences in facial muscle features but not consistently understanding the psychological meaning of the categories.

Perhaps the clearest evidence for discrete emotion perception in children exists in a recent study that directly compared perception of posed portrayals of anger and disgust (Ruba, Johnson, Harris, & Wilbourn, 2017). This study offers a

particularly well-controlled comparison because anger and disgust are thought to be similar in valence and arousal (Russell & Bullock, 1986a, 1986b) and caricatured portrayals of these facial expressions even share similar facial muscle movements (e.g., corrugator activity). The authors found that both 10-month-old infants and 18-month-old infants showed discrimination for angry and disgusted faces. Although 10 months old were unable to discriminate identities, 18 months old were able to, and familiar identities enhanced their ability to discriminate between angry and disgusted faces. Interestingly, children older than 24 months and adults struggle to categorize these faces using labeling and free-sort tasks, suggesting that younger children may rely more on perceptual statistical regularities to differentiate the faces. It is unclear, however, whether these younger children understand the meaning of the perceptual regularities they are distinguishing. Patients who have lost access to the meaning of words as a result of semantic dementia can perceptually match posed facial expressions on the basis of statistical regularities in the posed muscle movements but do not understand the psychological meaning of those facial muscle movements when asked to sort them into meaningful categories (Lindquist et al., 2014).

Language Acquisition Across Childhood Accompanies Discrete Emotion Perception

If language is necessary for discrete emotion perception, then it follows that discrete emotion perception should emerge as children begin to learn the meaning of emotion category words. That is, a child who knows the words "anger" and "sadness" should be able to differentiate between these two same-valence emotions. The literature, although correlational, bears out this pattern across early childhood. We also briefly discuss more causal evidence that emotion word acquisition influences adult's discrete emotion perception.

To test the hypothesis that children can differentiate between different discrete emotions once they know the meaning of specific emotion category words, studies typically use behavioral methods. Like the infant literature, much research focuses on emotion perception using facial stimuli, and we focus our attention on this literature. We also briefly touch on work on emotion concept understanding, more generally.

Studies of emotion perception in children over 24 months typically ask children to categorize expressions using one of three types of paradigms. In one type of paradigm, children perform an emotion perspective-taking task, wherein the child is presented with a short story (often by puppets or with a neutral image of a face) and asked to identify what the character is feeling either through free labeling or pointing to facial expression response options (Cutting & Dunn, 1999). Alternatively, the child might be given a facial expression (e.g., a happy face) and is asked to freely label it (Widen & Russell, 2003). In other types of paradigms, the child is given an emotion word (e.g., happy) and is asked to point to facial expression response options that match the word (Denham & Couchoud, 1990). Finally, a child might be asked to sort facial expressions of a certain category into one box while leaving out others (Widen & Russell, 2008c).

Of course, many of these paradigms rely on words, so it is not surprising that children's age and language ability are generally positively correlated with performance in emotion perception tasks (Astington & Jenkins, 1999; Beck, Kumschick, Eid, & Klann-Delius, 2012; Cutting & Dunn, 1999; Harris, De Rosnay, & Pons, 2005; Pons et al., 2004, 2003; Wellman, Harris, Banerjee, & Sinclair, 1995). There is a well-known developmental trajectory in children's use of mental state words. When describing others, very young children (e.g., 2.5 years) primarily discuss external sensory perceptions (i.e., visual perceptions of others; e.g., the girl runs). With time, these descriptions become more internal and more complex, focusing on physiological states (feeling sick, hot), volition (desires), and, lastly, emotion, cognition, and moral judgments (Bretherton & Beeghly, 1982). Word use related to emotions also follows a developmental trajectory, and as predicted by

the psychological constructionist account, this trajectory starts broad, focusing on valence, and gets more specific with development (Widen, 2013). Prior to the age of two, children generally rely on "happy" and depending on the child, "sad" or "mad," to describe pleasant vs. unpleasant feelings. With age, word use expands to include "happy," "mad," "sad," and, eventually, "scared," "surprised," and "disgust" (Bretherton & Beeghly, 1982; Ridgeway et al., 1985; Widen & Russell, 2003; for review, see Widen, 2013). Notably, disgust is not reliably used until well into childhood (e.g., around age 7) (Widen & Russell, 2008b, 2013).

However, what is particularly interesting about these findings, and consistent with a psychological constructionist account, is that children's linguistic and corresponding conceptual abilities correlate with their perceptual abilities and emotion understanding. For example, preschoolers that are older and have better language ability are better able to correctly identify what a target character is feeling and label facial expressions when prompted (Cutting & Dunn, 1999). Bosacki and Moore (2004) find that 3-year-old children's language influences their ability to understand simple (happy or sad) vs. more complex (embarrassed or proud) emotion categories. Specifically, when asked to identify what a puppet is feeling, accuracy in identifying the emotion portrayed by the researchers was positively associated with general verbal ability. This suggests that language influences the ability to perceive and identify emotions in others. In addition to the role of language, the authors also found that the more stereotypically female the child's behavior, the more accurate the child was to understand the character's complex emotions. This finding in and of itself is likely related to the acquisition of emotion words, a point we return to later.

Of course, the aforementioned findings could be merely interpreted as evidence that as children age, they become better at emotion perception and understanding. A developmental effect surely exists, but language ability remains a strong predictor for emotion understanding performance among 3- to 6-year-old children when controlling for age, parental attachment, and gender (de Rosnay & Harris, 2002). Furthermore, language ability accounts for more variance than age alone, suggesting that language ability has a larger impact on emotion understanding than age per se (Pons et al., 2003). Indeed, language ability is related to improved performance in false belief tasks and emotion-based attributions (de Rosnay, Pons, Harris, & Morrell, 2004). Here, 3- to 6-year-old children who have higher language ability and were deemed to be more mentalistic (or introspective) by their mothers were more likely to understand an association between a target character's emotional state and beliefs or knowledge of a situation as compared to children low in language and metalizing abilities.

Taken together, the findings show a relationship between language ability and emotion perception and understanding but do not speak to the psychological mechanisms underlying this relationship. Our psychological constructionist approach hypothesizes that language ability is important to emotion because language conveys information about the emotion concepts that a child in turn uses to make meaning of the range of pleasant and unpleasant feelings, behaviors, and situations that accompany different discrete emotions. This hypothesis predicts two outcomes: first, that learning specific discrete emotion concept words should drive discrete emotion perception in children and, second, that greater opportunities for learning concepts through language should predict better emotion perception and understanding.

Learning Emotion Words Is Associated with Emotion Perception

Children's use of discrete emotion words (e.g., "anger," "fear," "sadness," "proud," etc.) increases with age, as seen in children's spontaneous word production during discourse (Ridgeway et al., 1985) and in free labeling of facial emotion expressions (Widen & Russell, 2003). Interestingly, children do not learn words for emotion categories all at once and instead follow

a trajectory from a narrow valence-based understanding of emotion category words to broader and more nuanced understanding that reflects differences among same-valenced emotions. For instance, at 2 years old, children on average use the words "happy" and "sad"[1] when labeling facial expressions and often overgeneralize their use of these terms in valence-congruent ways. For example, they tend to label all negative facial emotion expressions as "sad," suggesting that what they understand about "sadness" is that it is a negative emotion. By 5 years, children use a broader range of words (including "surprise," "fear," and sometimes "disgust") and are correspondingly better able to differentiate negative emotions as indicated by a decrease in broadly categorizing all negative faces as "sad" (Widen & Russell, 2008c).

To quasi-experimentally examine the effect of children's emotion word knowledge and perceptual abilities, Widen and Russell (2008c) examined 2- to 5-year-old children's ability to produce emotion labels and then examined their behavior in a perceptual sorting task. To understand how many labels children knew, children first freely labeled facial emotion expressions. Children were more likely to use the words "anger," followed by "happy," "sad," "surprise," "fear," and "disgust." Consistent with other literature, older children had the largest range of emotion word knowledge. Next, children performed a face sort task in which they were asked to place certain emotional faces (e.g., sad faces) into a labeled box (e.g., the "sad" box). Consistent with the idea that emotion word knowledge is associated with emotion perception, children's accuracy and pattern of errors was associated with how many emotion words they knew. Across all ages, children were more likely to make same-valence errors (i.e., place a fearful expression in a box labeled "sad"), but the likelihood of the error decreased with greater emotion word knowledge. That is, children who knew the word "fear" were less likely to place a fearful face in the "sad" box.

Other evidence is suggestive that emotion words are particularly important for organizing children's knowledge about emotion concepts and helping them to access this knowledge during online tasks. That is, children show a "label superiority" effect (Russell & Widen, 2002) when it comes to emotional understanding and perception, whereby they perform much better when cued by an emotion word vs. a face or other information. For instance, Camras and Allison (1985) found that children from preschool to second grade are better able to identify what a character in a story is feeling when given emotion word options ("happy," "angry," "sad," "fear," and "disgust") rather than facial expressions depicting the target emotions. Extending these findings to a younger sample, Russell and Widen (2002) found that words, but not faces, facilitated emotion understanding and emotion perception in 2 to 7 years old. First to test emotion understanding, children were asked to tell a story about a cued emotion concept and were either shown the relevant emotion word (e.g., "anger" or a facial expression of the target emotion, e.g., an angry face). Children were less likely to describe a story reflective of the target emotion when cued with a facial expression, whereas they more clearly described an event eliciting the target emotion when cued with a word. To test emotion perception, children performed the same emotion face categorization task as used in Widen and Russell (2008a), but here they were either cued to place faces in a box labeled with a word (an "angry" box), a box labeled with the target facial expression (e.g., a box depicting an angry face), or a box labeled with a label plus facial expression. Children performed most accurately when the boxes were labeled with emotion word labels and worst when the boxes were denoted with a facial expression. Interestingly, when boxes had both emotion words and facial expressions, performance did not differ from the condition in

[1]Some children use "mad" instead of "sad" to indicate negative emotion (see Widen, 2013). The reason for this difference is unknown, but it's possible that this reflects differences in parents' choice of negative emotion words, which could stem from individual differences or even gender norms. There is some evidence that 3 year olds are more likely to ascribe "sadness" to girls and "anger" to boys (Haugh et al. 1980), suggesting that children learn gender-based associations with emotion categories even as they are learning about the categories themselves.

which boxes only had emotion words, suggesting that facial expressions do not add any additional information above and beyond the label for guiding children's perceptual judgments.

Taken together, these findings suggest that emotion words play an especially important role in cuing children to the meaning of emotion concepts. Interestingly, this same effect persists into adulthood, such that adults are more accurate at matching a face to a label than matching two facial expressions to one another (Nook, Lindquist, & Zaki, 2015). These findings run counter to the idea that all children are born automatically understanding facial expressions for basic emotions (Izard, 1971, 1994; Izard & Malatesta, 1987) and need to merely learn to apply labels to them during language acquisition. Rather, these findings are consistent with our constructionist view that words act as an "essence placeholder" that unites together perceptual instances (e.g., different instances of angry facial expressions) in concept knowledge and helps humans access that knowledge when making meaning of a new instance of that category. Evidence from cognitive science suggests that words play a special role in representing abstract concepts (Andrews, Vigliocco, & Vinson, 2009; Barsalou & Wiemer-Hastings, 2005) and in turn shape online perception (Lupyan, 2012; see Lindquist et al. 2015a for a discussion in the realm of emotion). The linguistic form of a concept helps people acquire category knowledge, above and beyond mere experience with that category (Doyle & Lindquist, 2018; Lupyan, Rakison, & McClelland, 2007). A word helps adult perceivers to acquire categories for novel emotional facial expressions and biases later perceptual memory for similar faces (Doyle & Lindquist, 2018). No studies to our knowledge have explicitly tested this hypothesis in children, but at least one study is suggestive that children are using novel words to acquire novel emotion categories.

Two- to 10 year-old children were presented with a series of facial expressions including a novel expression made up by the researchers and were asked which word denoted the expression (Nelson & Russell, 2016). Critically, children were provided with a list of typical English emotion words plus a new word, "pax." After a few trials, children began to use the new label, "pax," to label the novel emotion, suggesting that children use the process of elimination to infer that a novel word corresponds to a novel emotional expression. These findings suggest that even children as young as 2 years begin to cohere novel categories around words when given the opportunity to do so. These findings bring us to the second hypothesis of our psychological constructionist view, which is that children who have greater opportunity for emotion word learning are more likely to acquire a set of complex emotion concepts, which in turn is associated with greater emotion perception abilities and better emotion understanding.

Parental Communication Is Associated with Emotion Perception and Understanding

One way in which children begin to learn and associate emotion words with emotion concepts may be through communication and socialization from their caregivers, allowing for increased exposure and experiences of emotional instances. Indeed, a large body of work suggests that the amount of discourse that occurs between caregivers and children predicts children's verbal ability, which in turn leads to improved emotion perception and understanding in others (Brackett et al., 2012; Eggum et al., 2011; Hagelskamp et al., 2013; Rivers et al., 2013; Twenge, Catanese, & Baumeister, 2003). Improved emotion understanding is in turn linked to better peer relationships and popularity in children as young as 5 years old (Dunn, 1995; Dunsmore & Karn, 2004).

The effect of parent discourse on emotion understanding and perception likely occurs because parental discourse offers an avenue for introducing emotion concepts (e.g., "he feels sad!") and helping children understand the properties of those concepts (e.g., "he's crying because he's sad," "taking his toy made him sad," "he'll be less sad if you give it back"). Consistent

with this interpretation, among 7- to 9-year-old children, receptive vocabulary (the ability to understand language from others), literacy (the ability to understand language from written text), and understanding of narrative structure (the ability to understand narratives) particularly predict children's emotion vocabulary (the number of emotion words known), declarative emotion knowledge (the extent to which children can identify what a character feels), awareness, and understanding of mixed emotions and performance in a facial emotion recognition task (Beck et al., 2012). On the other hand, children with low levels of receptive language are more likely to demonstrate consistent maladaptive behaviors and poor emotion regulation (Cohen & Mendez, 2009). These findings suggest that language may be a vehicle for acquiring emotion concept knowledge because it allows parents to teach children about categories, causal relationships (Dunn, Brown, & Beardsall, 1991), and specific causes and consequences of emotions (Russell, 1990; Widen, Pochedly, & Russell, 2015).

On the parents' side, a number of factors predict children's acquisition of emotion knowledge (Chaplin, Cole, & Zahn-Waxler, 2005; Dunsmore & Halberstadt, 2009; Eisenberg, Cumberland, & Spinrad, 1998; Halberstadt, 1986; Halberstadt & Eaton, 2002; McClure, 2000; Wong, McElwain, & Halberstadt, 2009). For instance, the extent to which a parent explains emotions, the frequency with which a parent uses emotion language, and how they respond to the child's emotions are strong predictors of the child's emotion understanding (Adams, Kuebli, Boyle, & Fivush, 1995; Denham & Kochanoff, 2002; Denham, Zoller, & Couchoud, 1994; Kuebli, Butler, & Fivush, 1995). Additionally, parental emotion displays (Castro, Halberstadt, Lozada, & Craig, 2014; Halberstadt, Dennis, & Hess, 2011; McElwain et al., 2007; Perlman et al., 2008) and beliefs about emotions (Castro et al., 2014; Dunsmore, Her, Halberstadt, & Perez-Rivera, 2009; Lozada, Halberstadt, Craig, Dennis, & Dunsmore, 2016) predict children's knowledge about emotions. For example, at 44 months, a child's cognitive-language ability and the extent to which a mother explained emotions, frequently used emotion language, and how they responded to the child's emotion predict the child's ability to identify facial expressions depicting emotions (Denham et al., 1994). These behaviors also impact a child's own social status among their peers, in that kindergarteners whose mothers believed teaching emotion words was important were more popular with their peers (Dunsmore & Karn, 2004).

Perhaps the most compelling evidence for the role of parental communication in emotion understanding comes from longitudinal research. Mother and sibling discourse with children as young as 36 months predicts children's ability to recognize emotions in others at age 6. In particular, the frequency of conversation, discussions about causality, and having a large variety of discussion topics in general are positively correlated with emotion recognition above and beyond language ability alone (Dunn et al., 1991). Longitudinal evidence further shows that mothers' language about "desire" when their child is 15 months old influences how children discuss mental states and their performance in identifying the facial expressions associated with vignettes at 24 months (Taumoepeau & Ruffman, 2006). At 33 months, children's mental state language was most influenced by mothers' earlier discussions of other people's thoughts and feelings (Taumoepeau & Ruffman, 2008). Additionally, there is evidence that peer relationships can be a source of emotion word knowledge. Children with more stable friendships demonstrated increases in emotion word knowledge over the course of a year (Denham et al., 2003).

Amidst these findings exist interesting gender differences: finding suggest that girls are superior to boys in emotion understanding (Brown, Craig, & Halberstadt, 2015; Chaplin et al., 2005; Garner, Robertson, & Smith, 1997; McClure, 2000; Montagne, Kessels, Frigerio, De Haan, & Perrett, 2005). Importantly, growing evidence suggests that these differences may be due to language too. Longitudinal evidence suggests that parents adjust how they speak about emotions to children of different gender (Adams et al., 1995; Kuebli et al., 1995). A lon-

gitudinal study with children aged 40 to 45 months (Fivush et al., 2000) found that mothers discussed a wider range of emotions and focused on negative emotions more with their daughters than sons. Critically, this gender difference emerged as the child grew older and was longitudinally associated with gender differences in children's discussion of emotions. A separate study of both mothers and fathers found that both parents talk about emotions more with their daughters than their sons (Fivush et al., 2000), underscoring the fact that parents may be reinforcing gender stereotypes about emotion—and providing girls with a greater repertoire of emotion knowledge—across early childhood.

Of course, the role of language in emotion perception and understanding does not end in early childhood. Changes in emotion concept knowledge and the language that supports this knowledge continue throughout childhood. A study found that emotion word knowledge roughly doubled every 2 years until the age of 11 (Baron-Cohen, Golan, Wheelwright, Granader, & Hill, 2010). Changes in emotion knowledge associated with those words continue into adolescence and early adulthood (O'Kearney & Dadds, 2004) and perhaps for the rest of life. For instance, in a sample of individuals aged 10 to 77 years old, language ability correlated with the complexity of participants' descriptions about their personal experiences of anger, fear, sadness, and happiness (as, not surprisingly, did age and mental development) (Labouvie-Vief et al., 1989). We next trace evidence for a link between language and emotion in adolescence through adulthood.

Emotion Language During Adolescence

Unlike the basic research in infancy and early childhood, the majority of work examining language and emotion in older childhood and adolescents does so in the context of mental health (Conti-Ramsden & Botting, 2008; Toppelberg, Medrano, Morgens, & Nieto-Castañon, 2002; Yew & O'Kearney, 2013; for review, see Salmon, O'Kearney, Reese, & Fortune, 2016) or with regard to emotion regulation (Eisenberg, Sadovsky, & Spinrad, 2005). These findings generally suggest that language abilities are a protective factor against mental health symptoms and behavioral problems and predict greater emotion regulation in adolescence. For instance, children with language impairments in early childhood (3–8 years) were two times more likely to have internalizing and externalizing symptoms at follow-up (2–12 years later) when compared to children with typical language development (Yew & O'Kearney, 2013). Children with language impairments are also more likely to have higher rates of anxiety and depression in adolescence (Conti-Ramsden & Botting, 2008). These findings echo work in early childhood showing that language is a mechanism for acquiring the complex emotion knowledge used in successful interpersonal communication and intrapersonal emotion regulation (see Hagelskamp et al., 2013; Lindquist et al., 2015a for a discussion).

In contrast to the research in infancy and early childhood, which mainly focus on emotion perceptions in others, the basic science research in typically developing adolescents focuses on adolescent's own self-reported emotional experiences or emotion understanding. This methodological emphasis likely reflects the fact that adolescents are better able to self-report their own emotional experiences than are children. This emphasis is also likely due to the fact that adolescents experience an increase in emotional reactivity (Arnett, 1999; Casey, Jones, & Hare, 2008; Hare et al., 2008; Silvers et al., 2012; Somerville, Jones, & Casey, 2010) and internalizing symptoms leading to an increase in mental health disorders (Garnefski, Kraaij, & van Etten, 2005; Hatzenbuehler, McLaughlin, & Nolen-Hoeksema, 2008; McLaughlin, Hatzenbuehler, & Hilt, 2009) as compared to children.

Very little work specifically examines the relationship between language and emotion understanding in healthy adolescents, but a recent study (Nook et al., 2017) of individuals aged 6 to 25 years is suggestive that increasing verbal knowledge (i.e., vocabulary scores) mediates the development of more nuanced emotion concept

knowledge during mid-childhood to early adulthood. Participants were asked to compare how similar emotion words (e.g., "anger" vs. "sad," "anger" vs. "happy") were to one another. Consistent with the work in young children (e.g., Widen, 2013), with increased age and vocabulary scores (as measured by the WASI-II), people's emotion concept knowledge transitioned from a valence-based understanding (i.e., emotion categories are solely differentiated in terms of good vs. bad) to a more nuanced multidimensional space (i.e., emotion categories are differentiated in terms of valence and arousal). This effect was mediated by verbal knowledge and was not attributable to fluid reasoning or the general ability to represent categories in a complex manner (Nook et al., 2017). These findings suggest that emotion understanding increases across adolescence and is mediated by language.

Another recent study weighed in on how adolescents use emotion words to describe their own emotional experiences (Nook et al., 2018). Individuals aged 5–25 completed a laboratory measure in which they rated how much a series of aversive images made them feel "angry," "disgusted," "sad," "scared," and "upset." The researchers calculated participants' degree of emotion differentiation (i.e., emotional granularity), which is a behavioral measure that assesses whether participants use words in a distinctive manner (i.e., describing an unpleasant experience as exclusively "angry") or in a manner that reflects the underlying valence of the experience (i.e., describing an unpleasant experience as "angry," "disgusted," "sad," "scared," and "upset") (Barrett, Gross, Christensen, & Benvenuto, 2001; Boden, Thompson, Dizén, Berenbaum, & Baker, 2013; Demiralp et al., 2012). Differentiation was quadratically associated with age, such that younger children and young adults were more likely to differentiate among their emotions, whereas adolescents were not. Interestingly, these findings were not associated with average emotion intensity, suggesting that endorsing multiple emotions was not merely a product of experiencing strong emotion in adolescence. Rather, it may be that changes in emotion concept knowledge across childhood to early adulthood predict differences in emotion differentiation. Younger children were more likely to report a single emotional experience, perhaps because they have a limited repertoire of emotion concepts to draw on (Widen, 2013) or because their emotion concepts are less differentiated (Nook et al., 2017). In contrast, adults' greater tendency to differentiate among emotion categories was not driven by a tendency to report single categories in a given instance, perhaps because adults recognize that in some cases, they can feel multiple emotions and in others they do not. Ultimately, the findings might be best described by changes to the complexity of emotion knowledge across the early age span, which is an interesting question that should be addressed in future research. Findings might also be related to the accessibility of emotion concepts across the age span. Whereas children might be less able to flexibly retrieve different emotion concepts during emotional experiences, adolescents might have difficulty suppressing access to multiple emotion concepts. Adults are likely able to do both well. These findings are consistent with the evidence that emotion word accessibility alters adults' emotional perceptions (Barrett, Lindquist, & Gendron, 2007; Gendron et al., 2012; Lindquist et al., 2006, 2014) and experiences (Lindquist & Barrett, 2008a), which we turn to next.

Manipulating Emotion Language Shifts Perceptions and Experiences of Emotion in Young Adults

By adulthood, it is assumed that individuals have a well-established cache of emotion knowledge and stable language ability, although it remains in question to what extent emotion knowledge changes across the adult age span (a point we consider briefly below). There is growing experimental evidence that language continues to alter young adults' emotion perception and experiences, although we do not review it at length herein since we have done so extensively elsewhere (Lindquist et al., 2015a, b, 2016; Lindquist, 2017). Instead, we focus briefly on several studies of healthy younger adults that experimentally

manipulate emotion word accessibility and correspondingly alter emotion perception and experience. These findings are suggestive that once emotion concept knowledge is acquired, manipulating access to this knowledge by manipulating language alters emotional perceptions and experiences.

Perhaps the clearest evidence that emotion words are important in emotion perception come from studies that experimentally impair access to emotion words and correspondingly impact emotion perception. These studies used some form of verbal interference such as verbal overshadowing (Roberson & Davidoff, 2000) or semantic satiation (see Black, 2004) to make emotion word meanings temporarily inaccessible and test the effect on emotion perception in faces. For instance, in semantic satiation, after repeating a relevant emotion word ("anger") 30 times (vs. 3 times), participants were less accurate and slower to indicate whether two facial expressions (e.g., two angry faces) matched in emotional content or not (Lindquist et al., 2006). A second study demonstrated that semantic satiation of the discrete emotion words impaired the perceptual processing of emotional faces, not just categorization required in matching tasks (Gendron et al., 2012). Specifically, satiating an emotion word (e.g., "anger") hindered the ability of the subsequent face (e.g., an angry face) to perceptually prime itself (e.g., the same angry face) on a subsequent trial. Perceptual priming is an effect that occurs outside of conscious control and thus suggests that semantic satiation of emotion words is interfering with low-level perceptual processes when making meaning of an emotional facial expression.

Evidence also suggests that increased access to emotion words alters adults' emotional experiences, as measured by self-report, behavior, and physiology. These studies generally manipulate participants' access to emotion concepts during an emotionally evocative scenario. For instance, participants heard a vignette that either primed emotion-neutral knowledge or which mentioned the words "fear" or "anger" before they experienced a negative or neutral mood induction. Finally, participants completed a measure of risk perception as an implicit measure of fear. Participants primed with fear demonstrated the greatest risk perception, but only if they also experienced the negative affect induction, suggesting that access to the word "fear" altered how they experienced their negative state (Lindquist & Barrett, 2008a).

In a more recent study, participants were primed with an emotion concept ("fear" vs. "sympathy") after completing an implicit measure that assessed their aversive reactions to racial outgroup members (Lee et al., 2018). White individuals who were encouraged to make meaning of their highly aversive reactions toward Black individuals as "sympathy" were less likely to self-report feeling fear toward Black individuals and were less likely to see Black faces as threatening. Being primed with "fear" also increased participants' skin conductance responses to Black faces.

Finally, other evidence from our lab shows that words continue to help adults acquire and update emotion categories. A study that asked participants to pair novel "alien" facial expressions with "alien" words vs. perform a control task (i.e., judge the color of the alien's skin) found that participants who paired novel facial expressions with words were more likely to use this category information to guide later perceptions of other target alien faces (Doyle & Lindquist, 2018). That is, just as is hypothesized to occur during early childhood, adults were using the verbal form of the word to cohere together properties of the novel emotion category. This concept knowledge was then accessed later when viewing other alien facial expressions and biased perceptions of the target faces toward the concept knowledge stored in memory. This effect even occurs for pre-existing emotion categories; pairing novel instances of non-stereotypical angry facial expressions with the word "anger" biased later perceptions of stereotypical angry facial expressions (Doyle & Lindquist, 2018). Thus, it is likely that associating perceptual properties with emotion words across the age span allows individuals to continue to update their cache of emotion knowledge.

Older Adults with Deteriorating Language Ability Perceive Valence Not Discrete Emotions

We close by reviewing the small literature focusing on the association between language and emotion in older adulthood. Although research examines alterations to the types of emotion categories that older adults self-report (Carstensen, Pasupathi, Mayr, & Nesselroade, 2000; Gross et al., 1997) or the use of emotion words (Pennebaker & Stone, 2003) across the adult life span, very little research has examined how language and emotion continue to interact into older age. It is likely that emotion words continue to support the acquisition of new emotion knowledge across the adult life span. Older adults are known to have more complex emotion understanding (Grossmann et al., 2010), and although little studied, it is possible that language mediates the evolution of emotion concept knowledge across older adulthood. For instance, our preliminary work shows that older adults associate words such as "anger," "disgust," and "fear" with fewer interoceptive properties (e.g., a beating heart) than do younger and middle-aged adults (MacCormack, Henry, Davis, & Lindquist, under review), suggesting that words may continue to serve as a mechanism for learning, updating, and using emotion concept knowledge across the adult age span. A better understanding of how language and emotion interact across the adult life span is an important topic of future study.

The majority of research on language and emotion in older age focuses on unhealthy aging as occurs in stroke and neurodegenerative disease. This work is interesting because it shows that as brain regions associated with language deteriorate due to stroke or disease, so too does emotion perception. In some cases (e.g., Lindquist et al., 2014), the patterns observed are the inverse of those observed in early development; as patients lose access to emotion words, their perceptions become more valence-based and less discrete.

Some of the earliest evidence for deficits in language and emotion come from a stroke patient, LEW. LEW had deficits in lexical retrieval following a stroke in his inferior frontal gyrus, a region associated with semantic retrieval (e.g., Grindrod, Bilenko, Myers, & Blumstein, 2008), and was correspondingly unable to perceive discrete emotions on faces (Roberson et al., 1999). On each of three testing occasions, LEW was asked to sort a set of morphed facial expressions (e.g., happy to angry to fearful) into piles. He created piles of facial expressions that were seemingly disorganized and did not correspond to English categories of facial expressions.

Like stroke, semantic dementia, a form of primary progressive aphasia that occurs in the latter half of the life span (Gorno-Tempini et al., 2011), offers an interesting lens for studying the role of language in emotion. Semantic dementia is a progressive neurodegenerative disease that results in impairments in concept availability and use (Hodges & Patterson, 2007). Patients with semantic dementia have pronounced lesions to the left anterior temporal lobe, a region involved in representing abstract concepts (Visser, Jefferies, & Lambon Ralph, 2010). These patients also tend to show difficulties labeling facial expressions of emotion, although the effect is typically interpreted as merely a deficit in naming (Calabria, Miniussi, Bisiacchi, Zanetti, & Cotelli, 2009; Rosen et al., 2004). However, we have demonstrated that patients with semantic dementia show predicted deficits in the perception of discrete emotion on faces, but not perceptions in valence, even in tasks that do not explicitly require labeling (Lindquist et al., 2014). Three patients with semantic dementia were asked to freely sort facial portrayals of happiness, sadness, anger, disgust, fear, and a neutral state into piles. Unlike age-matched controls, who sorted into roughly six piles for the six categories represented, patients sorted into roughly three piles representing pleasant, unpleasant, and neutral valence (Lindquist et al., 2014). Despite manipulating the availability of cues (anchoring piles with numbers 1–6; anchoring piles with prototypical facial expressions; labeling piles with emotion words), patients persisted in perceiving faces in terms of valence. Indeed, other research examining neurodegeneration in areas related to semantic retrieval and use (e.g., inferior

frontal gyrus, anterior temporal lobe) also find that patients have impaired emotion perception. Those patients with behavioral variant frontotemporal dementia (bvFTD) who had lesions in the inferior frontal gyrus and anterior temporal lobe also showed deficits in emotion perception (Jastorff et al., 2016), further confirming the role of these language-related regions in emotion perception.

Conclusion

The evidence reviewed herein suggests that language is an important mechanism in emotion perception and understanding from infancy through older adulthood. These findings are consistent with the psychological constructionist hypothesis that language supports the acquisition of the emotion knowledge that in turn shapes how people make meaning of other's facial expressions, how they understand emotion categories, and perhaps even how they experience their own emotions. Consistent with the psychological constructionist hypothesis, preverbal infants do not show clear evidence for discrete emotion perception; discrete emotion perception appears to follow a broad (valenced) to narrow (discrete emotional) developmental trajectory as children learn emotion words such as "anger," "disgust," and "fear." Language ability is a clear predictor of emotional understanding across early childhood and even into adulthood, and parents' use of emotion words in discourse with their children causally predicts emotion understanding and a host of other positive socio-emotional outcomes. Across adolescence, language predicts the development of more nuanced representations of emotion categories. In adulthood, experimentally reducing access to emotion words impairs emotion perception, whereas increasing access to emotion concepts alters how adults make meaning of their own body states as specific discrete emotions. Finally, in disordered aging, loss of function to brain areas associated with the semantic aspects of language produces profound changes to emotion perception that recapitulate the patterns of emotion perception observed in early development. Without access to emotion words, adults with semantic dementia can perceive facial expressions in terms of broad valence, but not discrete emotions.

Limitations and Future Directions

Although we review converging evidence from multiple methods (including both correlational and experimental techniques), the findings we reviewed are not without limitations. Throughout, we noted caveats with the existing evidence as we reviewed it. For instance, it is difficult if not impossible to address some hypotheses in preverbal infants and young children. For this reason, much research in infants and young children focuses on emotion perception rather than emotional experience, as it is difficult to assess how an infant is feeling without asking them, and objective physiological measures cannot "diagnose" the experience of a specific emotion (Siegel et al., 2018). The infant literature has, at best, mixed evidence of discrete emotion perception. Most studies are not designed to rule out the role of other factors in perception (e.g., valence) and those studies that do have mixed findings and order effects. Although null or mixed findings do not rule out the possibility that infants can in fact easily perceive and understand discrete emotions, the evidence at present is more consistent with the hypothesis that infants perceive facial expressions in terms of valence and develop the ability to understand them in terms of discrete emotion categories over time. Interestingly, children's ability to perceive discrete emotions on faces covaries with their understanding of the corresponding emotion word. Although, as noted earlier, there is growing research documenting the role of language in emotion experience throughout adulthood, this literature, and for reasons outlined above, has not been extended across the life span. It is important that we continue to innovate and explore new and rigorous methods that may be able to capture the role of language in emotion experiences, even in research subjects who cannot self-report their own subjective states.

The correlational evidence across early childhood suggests that language is involved as infants and young children learn to differentiate the meaning of emotional faces. These studies are of course limited by their correlational nature. Some studies use longitudinal approaches, but even these are open to third variables. However, evidence from school-based interventions that aim to increase children's emotion knowledge are suggestive that increasing children's emotion word knowledge predicts a host of socio-emotional outcomes and mirror the observational data. Training programs thus far suggest that improved emotion knowledge facilitates both better peer relationships (Denham et al., 2003; Dunn, 1995; Dunsmore & Karn, 2004; Eggum et al., 2011) and academic success. Future research should examine the specific role of language in these school-based interventions. Our work in adults suggests that pairing emotion concepts with emotion words is likely to help people learn novel emotion concepts better than learning those concepts without the aid of language (Doyle & Lindquist, 2018).

Future research should also employ more experiments to examine the precise mechanisms by which language helps children acquire emotion knowledge. We have conducted studies examining how children learn to associate emotional concepts with novel word forms (Shablack et al., under review), but much more research is needed. The evidence showing that impaired language ability and limited emotion knowledge in childhood are associated with worse mental health outcomes in adolescence provides an additional incentive to identify the mechanisms by which language impacts emotional well-being.

As we noted, experimental approaches are used more extensively in adulthood to assess the precise mechanisms by which language impacts emotion understanding, perception, and experience, but there is a relative dearth of evidence focused on the role of language in older age. With a rapidly aging world population, it would be important to know how the relationship between language and emotion continues to develop across the adult life span.

Finally, although we did not discuss crosslinguistic research, it would be important in future research to examine how speaking different languages differently impact emotions, which can continue to inform us of both roles of culture and language in emotion development. There is ongoing research examining the role of bilingualism on emotion (Dewaele & Pavlenko, 2004), and hypotheses suggest that speaking two or more languages may provide a person with a more complex cache of emotion knowledge (Alvarado & Jameson, 2011; Dewaele & Pavlenko, 2002; Ozanska-Ponikwia, 2013; Panayiotou, 2004; Panicacci, 2013; Pavlenko, 2005, 2008; Pavlenko & Driagina, 2007). Indeed a recent review, Koven (2017) discusses differing theoretical views and approaches to the nature and structure of emotions in multilingual individuals and stresses the importance of continued exploration and, importantly, interdisciplinary examination of emotions in multilingual individuals. We look forward to this future research on the role of language and emotion across the life span and across the globe.

References

Adams, S., Kuebli, J., Boyle, P. A., & Fivush, R. (1995). Gender differences in parent-child conversations about past emotions: A longitudinal investigation. *Sex Roles, 33*(5–6), 309–323. https://doi.org/10.1007/BF01954572

Adolphs, R., Gosselin, F., Buchanan, T. W., Tranel, D., Schyns, P., & Damasio, A. R. (2005). A mechanism for impaired fear recognition after amygdala damage. *Nature, 433*(7021), 68–72. Retrieved from https://doi.org/10.1038/nature03086

Alvarado, N., & Jameson, K. A. (2011). Shared knowledge about emotion among Vietnamese and English bilingual and monolingual speakers. *Journal of Cross-Cultural Psychology, 42*(6), 963–982. https://doi.org/10.1177/0022022110381125

Andrews, M., Vigliocco, G., & Vinson, D. (2009). Integrating experiential and distributional data to learn semantic representations. *Psychological Review, 116*(3), 463–498. https://doi.org/10.1037/a0016261

Arnett, J. J. (1999). Adolescent storm and stress, reconsidered. *American Psychologist, 54*(5), 317–326. https://doi.org/10.1037/0003-066X.54.5.317

Astington, J. W., & Jenkins, J. M. (1999). A longitudinal study of the relation between language and theory-of-mind development. *Developmental*

Psychology, 35(5), 1311–1320. https://doi.org/10.1037//0012-1649.35.5.1311

Atkinson, A. P., Dittrich, W. H., Gemmell, A. J., & Young, A. W. (2004). Emotion perception from dynamic and static body expressions in point-light and full-light displays. *Perception, 33*(6), 717–746. https://doi.org/10.1068/p5096

Aviezer, H., Trope, Y., & Todorov, A. (2012, November). Body cues, not facial expressions, discriminate between intense positive and negative emotions. *Science, 338*, 1225–1229. https://doi.org/10.1126/science.1224313

Balaban, M. T. (1995). Affective influences on startle in five-month-old infants: Reactions to facial expressions of emotion. *Child Development, 66*(1), 28–36. https://doi.org/10.1111/j.1467-8624.1995.tb00853.x

Baron-Cohen, S., Golan, O., Wheelwright, S., Granader, Y., & Hill, J. (2010, November). Emotion word comprehension from 4 to 16 years old: A developmental survey. *Frontiers in Evolutionary Neuroscience, 2*. https://doi.org/10.3389/fnevo.2010.00109

Barrera, M. E., & Maurer, D. (1981). The perception of facial expressions by the three-month-old. *Child Development, 52*, 203–206.

Barrett, L. F. (2006). Solving the emotion paradox: Categorization and the experience of emotion. *Personality and Social Psychology Review, 10*(1), 20–46.

Barrett, L. F. (2009). Variety is the spice of life: A psychological construction approach to understanding variability in emotion. *Cognition & Emotion, 23*(7), 1284–1306. https://doi.org/10.1080/02699930902985894

Barrett, L. F. (2012). Emotions are real. *Emotion, 12*, 413–429.

Barrett, L. F. (2013). Psychological construction: A Darwinian approach to the science of emotion. *Emotion Review, 5*, 379–389.

Barrett, L. F. (2014). The conceptual act theory: A precis. https://doi.org/10.1177/1754073914534479

Barrett, L. F., & Bliss-Moreau, E. (2009). Affect as a psychological primitive. *Advances in Experimental Social Psychology, 41*, 167–218.

Barrett, L. F., Gross, J., Christensen, T. C., & Benvenuto, M. (2001). Knowing what you're feeling and knowing what to do about it: Mapping the relation between emotion differentiation and emotion regulation. *Cognition and Emotion, 15*(6), 713–724. https://doi.org/10.1080/02699930143000239

Barrett, L. F., Lindquist, K. A., & Gendron, M. (2007). Language as context for the perception of emotion. *Trends in Cognitive Sciences, 11*(8), 327–332.

Barsalou, L. W., & Wiemer-Hastings, K. (2005). Situating abstract concepts. In D. Pecher (Ed.), *Grounding cognition: The role of perception and action in memory, language, and thought* (pp. 129–163). New York: Cambridge University Press.

Baumeister, R. F., Vohs, K. D., DeWall, C. N., & Zhang, L. (2007). How emotion shapes behavior: Feedback, anticipation, and reflection, rather than direct causation. *Personality and Social Psychology Review, 11*(2), 167–203. https://doi.org/10.1177/1088868307301033

Beck, L., Kumschick, I. R., Eid, M., & Klann-Delius, G. (2012). Relationship between language competence and emotional competence in middle childhood. *Emotion, 12*(3), 503–514. https://doi.org/10.1037/a0026320

Black, S. (2004). Review of semantic satiation. *Advances in Psychology Research, 26*, 63–74.

Boden, M. T., Thompson, R. J., Dizén, M., Berenbaum, H., & Baker, J. P. (2013). Are emotional clarity and emotion differentiation related? *Cognition and Emotion, 27*(6), 961–978. https://doi.org/10.1080/02699931.2012.751899

Bogart, K. R., & Matsumoto, D. (2010). Facial mimicry is not necessary to recognize emotion: Facial expression recognition by people with Moebius syndrome. *Social Neuroscience, 5*(2), 241–251. https://doi.org/10.1080/17470910903395692

Bornstein, M. H., & Arterberry, M. E. (2003). Recognition, discrimination and categorization of smiling by 5-month-old infants. *Developmental Science, 6*(5), 585–599.

Bosacki, S. L., & Moore, C. (2004). Preschoolers' understanding of simple and complex emotions: Links with gender and language. *Sex Roles, 50*(9/10), 659–675. https://doi.org/10.1023/B:SERS.0000027568.26966.27

Brackett, M. A., Rivers, S. E., Reyes, M. R., & Salovey, P. (2012). Enhancing academic performance and social and emotional competence with the RULER feeling words curriculum. *Learning and Individual Differences, 22*(2), 218–224. https://doi.org/10.1016/j.lindif.2010.10.002

Bretherton, I., & Beeghly, M. (1982). Talking about internal states: The acquisition of an explicit theory of mind. *Developmental Psychology, 18*(6), 906–921. https://doi.org/10.1037/0012-1649.18.6.906

Bridges, K. M. B. (1932). Emotional development in early infancy. *Child Development, 3*(4), 324. https://doi.org/10.2307/1125359

Brooks, J. A., Shablack, H., Gendron, M., Satpute, A. B., Parrish, M. H., & Lindquist, K. A. (2017). The role of language in the experience and perception of emotion: a neuroimaging meta-analysis. *Social Cognitive and Affective Neuroscience, 12*(2). https://doi.org/10.1093/scan/nsw121

Brown, G. L., Craig, A. B., & Halberstadt, A. G. (2015). Parent gender differences in emotion socialization behaviors vary by ethnicity and child gender. *Parenting, 15*(3), 135–157. https://doi.org/10.1080/15295192.2015.1053312

Bullock, M., & Russell, J. A. (1986). Concepts of emotion in developmental psychology. In C. E. Izard & P. B. Read (Eds.), *Measuring emotions in infants and children* (pp. 203–237). Cambridge: Cambridge University Press.

Calabria, M., Miniussi, C., Bisiacchi, P. S., Zanetti, O., & Cotelli, M. (2009). Face–name repetition priming in semantic dementia: A case report. *Brain and Cognition, 70*, 231–237.

Camras, L. A., & Allison, K. (1985). Children's understanding of emotional facial expressions and verbal labels. *Journal of Nonverbal Behavior, 9*(2), 84–94. https://doi.org/10.1007/BF00987140

Camras, L. A., Oster, H., Bakeman, R., Meng, Z., Ujiie, T., & Campos, J. J. (2007). Do infants show distinct negative facial expressions for fear and anger? Emotional expression in 11-month-old European American, Chinese, and Japanese infants. *Infancy, 11*(2), 131–155.

Camras, L. A., & Shutter, J. M. (2010). Emotional facial expressions in infancy. *Emotion Review, 2*(2), 120–129.

Caron, R. F., Caron, A. J., & Myers, R. S. (1982). Abstraction of invariant face expressions in infancy. *Child Development, 53*, 1008–1015. https://doi.org/10.2307/1129141

Caron, R. F., Caron, A. J., & Myers, R. S. (1985). Do infants see emotional expressions in static faces. *Child Development, 53*, 1552–1560.

Carstensen, L. L., Pasupathi, M., Mayr, U., & Nesselroade, J. R. (2000). Emotional experience in everyday life across the adult life span. *Journal of Personality and Social Psychology, 79*(4), 644–655. https://doi.org/10.1037//0022-3514.79.4.644

Casey, B. J., Jones, R. M., & Hare, T. A. (2008). The adolescent brain. *Annals of the New York Academy of Sciences*. https://doi.org/10.1196/annals.1440.010

Castro, V. L., Halberstadt, A. G., Lozada, F. T., & Craig, A. B. (2014). Parents' emotion-related beliefs, behaviours, and skills predict children's recognition of emotion. *Infant and Child Development*, n/a–n/a. doi: https://doi.org/10.1002/icd.1868

Chaplin, T. M., Cole, P. M., & Zahn-Waxler, C. (2005). Parental socialization of emotion expression: Gender differences and relations to child adjustment. *Emotion, 5*(1), 80–88. https://doi.org/10.1037/1528-3542.5.1.80

Chester, D. S., Lynam, D. R., Milich, R., Powell, D. K., Andersen, A. H., & DeWall, C. N. (2016). How do negative emotions impair self-control? A neural model of negative urgency. *NeuroImage, 132*, 43–50. https://doi.org/10.1016/j.neuroimage.2016.02.024

Clore, G. L., & Ortony, A. (2008). Appraisal theories: How cognition shapes affect into emotion. In J. M. Haviland-Jones, M. Lewis, & L. F. Barrett (Eds.), *Handbook of emotions* (Vol. 3, pp. 628–642). New York: Guilford.

Clore, G. L., & Ortony, A. (2013). Psychological construction in the OCC model of emotion. *Emotion Review, 5*, 335–343.

Cohen, J. S., & Mendez, J. L. (2009). Emotion regulation, language ability, and the stability of preschool children's peer play behavior. *Early Education & Development, 20*(6), 1016–1037. https://doi.org/10.1080/10409280903305716

Conti-Ramsden, G., & Botting, N. (2008). Emotional health in adolescents with and without a history of specific language impairment (SLI). *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 49*(5), 516–525. https://doi.org/10.1111/j.1469-7610.2007.01858.x

Cunningham, W. A., & Brosch, T. (2012). Motivational salience: Amygdala tuning from traits, needs, values, and goals. *Current Directions in Psychological Science, 21*, 54–59.

Cunningham, W. A., Dunfield, K. A., & Stillman, P. E. (2013). Emotional states from affective dynamics. *Emotion Review, 5*, 344–355.

Cutting, A. L., & Dunn, J. (1999). Theory of mind, emotion understanding, language, and family background: Individual differences and interrelations. *Child Development, 70*(4), 853–865. https://doi.org/10.1111/1467-8624.00061

de Haan, M., & Nelson, C. A. (1998). Discrimination and categorisation of facial expressions of emotion during infancy. In A. Slater (Ed.), *Perceptual development: Visual, auditory, and speech perception in infancy* (pp. 287–309). Hove, UK: Psychology Press.

de Rosnay, M., & Harris, P. L. (2002). Individual differences in children's understanding of emotion: the roles of attachment and language. *Attachment & Human Development, 4*(February 2015), 39–54. https://doi.org/10.1080/14616730210123139

de Rosnay, M., Pons, F., Harris, P. L., & Morrell, J. M. B. (2004). A lag between understanding false belief and emotion attribution in young children: Relationships with linguistic ability and mothers' mental-state language. *British Journal of Developmental Psychology, 22*(2), 197–218. https://doi.org/10.1348/026151004323044573

D'Entremont, B., & Muir, D. W. (1997). Five-months-olds' attention and affective responses to still-faced emotional expressions. *Infant Behavior and Development, 20*(4), 563–568. https://doi.org/10.1016/S0163-6383(97)90047-3

Demiralp, E., Thompson, R. J., Mata, J., Jaeggi, S. M., Buschkuehl, M., Barrett, L. F., … Jonides, J. (2012). Feeling blue or turquoise? Emotional differentiation in major depressive disorder. *Psychological Science, 23*(11), 1410–1416. https://doi.org/10.1177/0956797612444903

Denham, S., & Kochanoff, A. T. (2002). Parental contributions to preschoolers' understanding of emotion. *Marriage & Family Review, 34*(3–4), 311–343. https://doi.org/10.1300/J002v34n03

Denham, S. A., Blair, K. A., DeMulder, E., Levitas, J., Sawyer, K., Auerbach-Major, S., & Queenan, P. (2003). Preschool emotional competence: Pathway to social competence? *Child Development, 74*(1), 238–256. https://doi.org/10.1111/1467-8624.00533

Denham, S. A., & Couchoud, E. A. (1990). Young preschoolers' understanding of emotions. *Child Study Journal, 20*(3), 171–192.

Denham, S. A., Zoller, D., & Couchoud, E. A. (1994). Socialization of preschoolers' emotion understanding. *Developmental Psychology, 30*(6), 928–936. https://doi.org/10.1037//0012-1649.30.6.928

Dewaele, J. M., & Pavlenko, A. (2002). Emotion vocabulary in interlanguage. *Language Learning*. https://doi.org/10.1111/0023-8333.00185

Dewaele, J. M., & Pavlenko, A. (2004). Languages and emotions: A crosslinguistic perspective. *Journal of*

Multilingual and Multicultural Development, 25(2–3), 93. https://doi.org/10.1080/01434630408666522

Dickson, K. L., Fogel, A., & Messinger, D. (1998). The development of emotion from a social process view. In M.F. Mascolo, & S. Griffin (Eds.). *What Develops in Emotional Development?* Boston, Springer.

Doyle, C. M., & Lindquist, K. A. (2018). When a word is worth a thousand pictures: Language shapes perceptual memory for emotion. *Journal of Experimental Psychology: General, 147*, 62–73.

Dunn, J. (1995). Children as psychologists: The later correlates of individual differences in understanding of emotions and other minds. *Cognition and Emotion, 9*(2–3), 187–201. https://doi.org/10.1080/02699939508409008

Dunn, J., Brown, J. R., & Beardsall, L. (1991). Family talk about feeling states and children's later understanding of others' emotions. *Developmental Psychology, 27*(3), 448–455. https://doi.org/10.1037/0012-1649.27.3.448

Dunsmore, J. C., & Halberstadt, A. G. (1997). How does family emotional expressiveness affect children's schemas? In K. C. Barrett (Ed.), *The communication of emotion: Current research from diverse perspectives* (pp. 45–68). San Francisco. CA: Jossey-Bass.

Dunsmore, J. C., & Halberstadt, A. G. (2009). The dynamic cultural context of emotion socialization. In *Pathways of human development: Explorations of change* (pp. 171–190). Lanham, MD: Lexington Books.

Dunsmore, J. C., Her, P., Halberstadt, A. G., & Perez-Rivera, M. B. (2009). Parents' beliefs about emotions and children's recognition of parents' emotions. *Journal of Nonverbal Behavior, 33*(2), 121–140. https://doi.org/10.1007/s10919-008-0066-6

Dunsmore, J. C., & Karn, M. A. (2004). The influence of peer relationships and maternal socialization on kindergartners' developing emotion knowledge. *Early Education & Development, 15*(1), 39–56. https://doi.org/10.1207/s15566935eed1501

Eggum, N. D., Eisenberg, N., Kao, K., Spinrad, T. L., Bolnick, R., Hofer, C., … Fabricius, W. V. (2011). Emotion understanding, theory of mind, and prosocial orientation: Relations over time in early childhood. *The Journal of Positive Psychology, 6*(1), 4–16. https://doi.org/10.1080/17439760.2010.536776

Eisenberg, N., Cumberland, A., & Spinrad, T. L. (1998). Parental socialization of emotion. *Psychological Inquiry, 9*(4), 241–273. https://doi.org/10.1207/s15327965pli0904_1

Eisenberg, N., Sadovsky, A., & Spinrad, T. L. (2005). Associations of emotion-related regulation with language skills, emotion knowledge, and academic outcomes. *New Directions for Child and Adolescent Development, 109*, 109–118. https://doi.org/10.2964/jsik.kuni0223

Ekman, P. (1972). Universals and cultural differences in facial expressions of emotion. In *Nebraska symposium on emotion and motivation, 1971* (pp. 207–283). Lincoln, Nebraska: University of Nebraska Press.

Ekman, P. (1992). An argument for basic emotions. *Cognition & Emotion, 6*(3), 169–200. https://doi.org/10.1080/02699939208411068

Ekman, P., & Cordaro, D. (2011). What is meant by calling emotions basic. *Emotion Review, 3*(4), 364–370. https://doi.org/10.1177/1754073911410740

Ereky-Stevens, K. (2008). Associations between mothers' sensitivity to their infants' internal states and children's later understanding of mind and emotion. *Infant and Child Development, 17*(5), 527–543. https://doi.org/10.1002/icd.572

Field, T. M., Woodson, R., Cohen, D., Greenberg, R., Garcia, R., & Collins, K. (1983). Discrimination and imitation of facial expressions by term and preterm neonates. *Infant Behavior and Development, 6*(4), 485–489. https://doi.org/10.1016/S0163-6383(83)90316-8

Field, T. M., Woodson, R., Greenberg, R., & Cohen, D. (1982). Discrimination and imitation of facial expression by neonates. *Science, 218*(4568), 179–181. https://doi.org/10.1126/science.7123230

Fivush, R., Brotman, M. A., Buckner, J. P., & Goodman, S. H. (2000). Gender differences in parent–child emotion narratives. *Sex Roles, 42*, 233–253. https://doi.org/10.1023/A:1007091207068

Fivush, R., Haden, C. A., & Reese, E. (2006). Elaborating on elaborations: Role of maternal reminiscing style in cognitive and socioemotional development. *Child Development, 77*(6), 1568–1588. https://doi.org/10.1111/j.1467-8624.2006.00960.x

Flom, R., & Bahrick, L. E. (2007). The development of infant discrimination of affect in multimodal and unimodal stimulation: The role of intersensory redundancy. *Developmental Psychology, 43*(1), 238.

Fogel, A., Nwokah, E., Dedo, J. Y., Messinger, D., Dickson, K. L., Matusov, E., & Holt, S. A. (1992). Social process theory of emotion: A dynamic systems approach. *Social Development, 1*(2), 122–142. https://doi.org/10.1111/j.1467-9507.1992.tb00116.x

Fridlund, A. J. (1991). Evolution and facial action in reflex, social motive, and paralanguage. *Biological Psychology*. https://doi.org/10.1016/0301-0511(91)90003-Y

Fridlund, A. J. (1994). *Human facial expression: An evolutionary view*. San Diego, CA: Academic.

Fugate, J. M. B. (2013). Categorical perception for emotional faces. *Emotion Review, 5*(1), 84–89. https://doi.org/10.1177/1754073912451350

Fugate, J. M. B., Gendron, M., Satoshi, F. N., & Barrett, L. F. (2017). Emotion words: Adding face value. *Emotion*.

Garnefski, N., Kraaij, V., & van Etten, M. (2005). Specificity of relations between adolescents' cognitive emotion regulation strategies and Internalizing and Externalizing psychopathology. *Journal of Adolescence, 28*(5), 619–631. https://doi.org/10.1016/j.adolescence.2004.12.009

Garner, P., Robertson, S., & Smith, G. (1997). Preschool children's emotional expressions with peers: The roles of gender and emotion socialization. *Sex Roles, 36*, 675–691. https://doi.org/10.1023/A:1025601104859

Geangu, E., Ichikawa, H., Lao, J., Kanazawa, S., Yamaguchi, M. K., Caldara, R., & Turati, C. (2016). Culture shapes 7-month-olds' perceptual strategies in discriminating facial expressions of emotion. *Current Biology*. https://doi.org/10.1016/j.cub.2016.05.072

Gendron, M., Lindquist, K. A., Barsalou, L., & Barrett, L. F. (2012). Emotion words shape emotion percepts. *Emotion, 12*(2), 314–325. https://doi.org/10.1037/a0026007

Goldstone, R. (1994). Influences of categorization on perceptual discrimination. *Journal of Experimental Psychology: General*, (*2*), 178–200.

Gorno-Tempini, M. L., Hillis, A. E., Weintraub, S., Kertesz, A., Mendez, M., Cappa, S. F., … Grossman, M. (2011). Classification of primary progressive aphasia and its variants. *Neurology, 76*, 1006–1014.

Gosselin, F., & Schyns, P. G. (2001). Bubbles: A technique to reveal the use of information in recognition tasks. *Vision Research, 41*(17), 2261–2271. https://doi.org/10.1016/S0042-6989(01)00097-9

Grazzani, I., Ornaghi, V., Conte, E., Pepe, A., & Caprin, C. (2018). The relation between emotion understanding and theory of mind in children aged 3 to 8: The key role of language. *Frontiers in Psychology, 9*(MAY), 1–10. https://doi.org/10.3389/fpsyg.2018.00724

Grindrod, C. M., Bilenko, N. Y., Myers, E. B., & Blumstein, S. E. (2008). The role of the left inferior frontal gyrus in implicit semantic competition and selection: An event-related fMRI study. *Brain Research, 1229*, 167–178. https://doi.org/10.1016/j.brainres.2008.07.017

Gross, J. J., Carstensen, L. L., Pasupathi, M., Tsai, J., Skorpen, C. G., & Hsu, A. Y. C. (1997). Emotion and aging: Experience, expression, and control. *Psychology and Aging, 12*(4), 590–599. https://doi.org/10.1037/0882-7974.12.4.590

Grossmann, I., Na, J., Varnum, M. E. W., Park, D. C., Kitayama, S., & Nisbett, R. E. (2010). Reasoning about social conflicts improves into old age. *Proceedings of the National Academy of Sciences, 107*(16), 7246–7250. https://doi.org/10.1073/pnas.1001715107

Grossmann, T. (2010). The development of emotion perception in face and voice during infancy. *Restorative Neurology and Neuroscience*. https://doi.org/10.3233/RNN-2010-0499

Hagelskamp, C., Brackett, M. A., Rivers, S. E., & Salovey, P. (2013). Improving classroom quality with the RULER Approach to social and emotional learning: Proximal and distal outcomes. *American Journal of Community Psychology, 51*(3–4), 530–543. https://doi.org/10.1007/s10464-013-9570-x

Haith, M. M., Bergman, T., & Moore, M. J. (1977). Eye contact and face scanning in early infancy. *Science, 198*(4319), 853–855. https://doi.org/10.1126/science.918670

Halberstadt, A. G. (1986). Family socialization of emotional expression and nonverbal communication styles and skills. *Journal of Personality and Social Psychology, 51*(4), 827–836. https://doi.org/10.1037/0022-3514.51.4.827

Halberstadt, A. G., Denham, S. A., & Dunsmore, J. C. (2001). Affective social competence. *Social Development, 10*(1), 79–119. https://doi.org/10.1111/1467-9507.00150

Halberstadt, A. G., Dennis, P. A., & Hess, U. (2011). The influence of family expressiveness, individuals' own emotionality, and self-expressiveness on perceptions of others' facial expressions. *Journal of Nonverbal Behavior, 35*(1), 35–50. https://doi.org/10.1007/s10919-010-0099-5

Halberstadt, A. G., & Eaton, K. L. (2002). A meta-analysis of family expressiveness and children's emotion expressiveness and understanding. *Marriage & Family Review, 34*(1–2), 35–62. https://doi.org/10.1300/J002v34n01_03

Halberstadt, A. G., & Lozada, F. T. (2011). Emotion development in infancy through the lens of culture. *Emotion Review, 3*(2), 158–168. https://doi.org/10.1177/1754073910387946

Hare, T. A., Tottenham, N., Galvan, A., Voss, H. U., Glover, G. H., & Casey, B. J. (2008). Biological substrates of emotional reactivity and regulation in adolescence during an emotional go-nogo task. *Biological Psychiatry, 63*(10), 927–934. https://doi.org/10.1016/j.biopsych.2008.03.015

Harris, P. L., De Rosnay, M., & Pons, F. (2005). Language and children's understanding of mental states. *Current Directions in Psychological Science*. https://doi.org/10.1111/j.0963-7214.2005.00337.x

Hatzenbuehler, M. L., McLaughlin, K. A., & Nolen-Hoeksema, S. (2008). Emotion regulation and internalizing symptoms in a longitudinal study of sexual minority and heterosexual adolescents. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 49*(12), 1270–1278. https://doi.org/10.1111/j.1469-7610.2008.01924.x

Haugh, S. S., Hoffman, C. D., & Cowan, G. (1980). The eye of the very young beholder: Sex typing of infants by young children. *Child Development, 51*(2), 598–600. http://dx.doi.org/10.2307/1129302

Hodges, J. R., & Patterson, K. (2007). Semantic dementia: a unique clinicopathological syndrome. *Lancet Neurology, 6*(11), 1004–1014. Retrieved from http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=17945154

Izard, C. E. (1971). *The face of emotion*. New York: Appleton-Century-Crofts. https://doi.org/10.1109/IGARSS.1992.578647

Izard, C. E. (1994). Innate and universal facial expressions: Evidence from developmental and cross-cultural research. *Psychological Bulletin, 115*(2), 288–299. https://doi.org/10.1037/0033-2909.115.2.288

Izard, C. E. (2007). Basic emotions, natural kinds, emotion schemas, and a new paradigm. *Perspectives on Psychological Science, 2*(3), 260–280. https://doi.org/10.1111/j.1745-6916.2007.00044.x

Izard, C. E., & Malatesta, C. Z. (1987). Perspectives on emotional development I: Differential emotions theory of early emotional development. In J. D. Osofsky (Ed.),

Wiley series on personality processes. Handbook of infant development (pp. 494–554). Oxford, England: Wiley.

Jack, R. E., Blais, C., Scheepers, C., Schyns, P. G., & Caldara, R. (2009). Cultural confusions show that facial expressions are not universal. *Current Biology, 19*(18), 1543–1548. https://doi.org/10.1016/j.cub.2009.07.051

Jack, R. E., Garrod, O. G. B., Yu, H., Caldara, R., & Schyns, P. G. (2012). Facial expressions of emotion are not culturally universal. *Proceedings of the National Academy of Sciences, 109*(19), 7241–7244. https://doi.org/10.1073/pnas.1200155109

Jastorff, J., De Winter, F. L., Van den Stock, J., Vandenberghe, R., Giese, M. A., & Vandenbulcke, M. (2016). Functional dissociation between anterior temporal lobe and inferior frontal gyrus in the processing of dynamic body expressions: Insights from behavioral variant frontotemporal dementia. *Human Brain Mapping, 37*(12), 4472–4486. https://doi.org/10.1002/hbm.23322

Kashdan, T. B., Barrett, L. F., & McKnight, P. E. (2015). Unpacking emotion differentiation: Transforming unpleasant experience by perceiving distinctions in negativity. *Current Directions in Psychological Science, 24*(1), 10–16. https://doi.org/10.1177/0963721414550708

Kassam, K. S., & Mendes, W. B. (2013). The effects of measuring emotion: physiological reactions to emotional situations depend on whether someone is asking. *PLoS One, 8*(7), e64959. https://doi.org/10.1371/journal.pone. 0064959PONE-D-12-38157 [pii].

Kestenbaum, R., & Nelson, C. A. (1990). The recognition and categorization of upright and inverted emotional expressions by 7-month-old infants. *Infant Behavior and Development, 13*(4), 497–511. https://doi.org/10.1016/0163-6383(90)90019-5

Kim, H., Somerville, L. H., Johnstone, T., Alexander, A. L., & Whalen, P. J. (2003). Inverse amygdala and medial prefrontal cortex responses to surprised faces. *Neuroreport, 14*(18), 2317–2322. https://doi.org/10.1097/01.wnr.0000101520.44335.20

Kim, H., Somerville, L. H., Johnstone, T., Polis, S., Alexander, A. L., Shin, L. M., & Whalen, P. J. (2004). Contextual modulation of amygdala responsivity to surprised faces. *Journal of Cognitive Neuroscience, 16*(10), 1730–1745. https://doi.org/10.1162/0898929042947865

Kirkland, T., & Cunningham, W. A. (2012). Mapping emotions through time: How affective trajectories inform the language of emotion. *Emotion, 12*, 268–282.

Kotsoni, E., de Haan, M., & Johnson, M. H. (2001). Categorical perception of facial expressions by 7-month-old infants. *Perception, 30*(9), 1115–1125. https://doi.org/10.1068/p3155

Koven, M. (2017). Language awareness and emotion. In J. Cenoz, D. Gorter, & S. May (Eds.), *Language awareness and multilingualism* (3rd ed., pp. 67–82). Cham, Switzerland: Springer. https://doi.org/10.1007/978-3-319-02325-0

Kuchuk, A., Vibbert, M., & Bornstein, M. H. (1986). The perception of smiling and its experimental correlates. *Child Development, 57*, 1054.

Kuebli, J., Butler, S., & Fivush, R. (1995). Mother-child talk about past emotions: Relations of maternal language and child gender over time. *Cognition and Emotion, 9*(2–3), 265–283. https://doi.org/10.1080/02699939508409011

Labouvie-Vief, G., DeVoe, M., & Bulka, D. (1989). Speaking about feelings: conceptions of emotion across the life span. *Psychology and Aging, 4*(4), 425–437. https://doi.org/10.1037/0882-7974.4.4.425

Lane, J. D., Wellman, H. M., Olson, S. L., LaBounty, J., & Kerr, D. C. R. (2010). Theory of mind and emotion understanding predict moral development in early childhood. *The British Journal of Developmental Psychology*. https://doi.org/10.1348/026151009X483056

Lee, K., Lindquist, K. A., & Payne, B. K. (2018). Constructing bias: Conceptualization breaks the link between implicit bias and fear of Black Americans. *Emotion, 18*(6), 855–871.

Lieberman, M. D., Eisenberger, N. I., Crockett, M. J., Tom, S. M., Pfeifer, J. H., & Way, B. M. (2007). Putting feelings into words. *Psychological Science, 18*(5), 421.

Lieberman, M. D., Inagaki, T. K., Tabibnia, G., & Crockett, M. J. (2011). Subjective responses to emotional stimuli during labeling, reappraisal, and distraction. *Emotion, 11*(3), 468–480. https://doi.org/10.1037/a0023503

Lindquist, K. A. (2013). Emotions emerge from more basic psychological ingredients: A modern psychological constructionist model. *Emotion Review, 5*, 356–368.

Lindquist, K. A. (2017). The role of language in emotion: existing evidence and future directions. *Current Opinion in Psychology*. https://doi.org/10.1016/j.copsyc.2017.07.006

Lindquist, K. A., & Barrett, L. F. (2008a). Constructing emotion: The experience of fear as a conceptual act. *Psychological Science, 19*(9), 898–903. https://doi.org/10.1111/j.1467-9280.2008.02174.x

Lindquist, K. A., & Barrett, L. F. (2008b). Emotional complexity. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (3rd ed.). New York: Guilford.

Lindquist, K. A., Barrett, L. F., Bliss-Moreau, E., & Russell, J. A. (2006). Language and the perception of emotion. *Emotion, 6*(1), 125–138. https://doi.org/10.1037/1528-3542.6.1.125

Lindquist, K. A., & Gendron, M. (2013). What's in a word? Language constructs emotion perception. *Emotion Review, 5*(1), 66–71. https://doi.org/10.1177/1754073912451351

Lindquist, K. A., Gendron, M., Barrett, L. F., & Dickerson, B. C. (2014). Emotion perception, but not affect perception, is impaired with semantic memory loss. *Emotion, 14*(2), 375–387. https://doi.org/10.1037/a0035293

Lindquist, K. A., Gendron, M., & Satpute, A. (2016). Language and emotion: Putting feelings into words and words into feelings. In M. Lewis, J. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (4th ed.). New York: Guildford.

Lindquist, K. A., MacCormack, J. K., & Shablack, H. (2015a). The role of language in emotion: Predictions from psychological constructionism. *Frontiers in Psychology, 6*(MAR). https://doi.org/10.3389/fpsyg.2015.00444

Lindquist, K. A., Satpute, A. B., & Gendron, M. (2015b). Does language do more than communicate emotion? *Current Directions in Psychological Science, 24*(2), 99–108. https://doi.org/10.1177/0963721414553440

Lozada, F. T., Halberstadt, A. G., Craig, A. B., Dennis, P. A., & Dunsmore, J. C. (2016). Parents' beliefs about children's emotions and parents' emotion-related conversations with their children. *Journal of Child and Family Studies, 25*(5), 1525–1538. https://doi.org/10.1007/s10826-015-0325-1

Ludemann, P. M., & Nelson, C. A. (1988). Categorical representation of facial expressions by 7-month-old infants. *Developmental Psychology, 24*(4), 492–501. https://doi.org/10.1037/0012-1649.24.4.492

Lupyan, G. (2012). Linguistically modulated perception and cognition: the label-feedback hypothesis. *Frontiers in Psychology, 3*, 54. https://doi.org/10.3389/fpsyg.2012.00054

Lupyan, G., Rakison, D. H., & McClelland, J. L. (2007). Language is not just for talking: Redundant labels facilitate learning of novel categories. *Psychological Science, 18*(12), 1077–1083.

MacCormack, J. K., Henry, T. R., Davis, B. M., & Lindquist, K. A. (under review). Aging bodies, aging emotions: Interoceptive differences in emotion knowledge and self-report across adulthood.

MacCormack, J. K., & Lindquist, K. A. (in press). Hanger: When hunger is conceptualized as emotion. *Emotion*.

Majid, A. (2012). Current Emotion Research in Language Sciences. *Emotion Review, 4*(4), 432–443. https://doi.org/10.1177/1754073916665470

Matsumoto, D. (1987). The role of facial response in the experience of emotion: More methodological problems and a meta-analysis. *Journal of Personality and Social Psychology, 52*(4), 769–774. https://doi.org/10.1037/0022-3514.52.4.769

Matsumoto, D. (1993). Ethnic differences in affect intensity, emotion judgments, display rules, and self-reported emotional expression. *Motivation and Emotion*, (17), 107–123.

Matsumoto, D., & Kupperbusch, C. (2001). Idiocentric and allocentric differences in emotional expression, experience, and the coherence between expression and experience. *Asian Journal of Social Psychology, 4*(2), 113–131. https://doi.org/10.1111/j.1467-839X.2001.00080.x

Maurer, D., & Salapatek, P. (1976). Developmental changes in the scanning of faces by young infants. *Child Development, 47*(2), 523–527. https://doi.org/10.2307/1128813

Mauss, I. B., & Robinson, M. D. (2009). Measures of emotion: A review. *Cognition & Emotion, 23*, 209–237.

Mayer, J. D., Salovey, P., & Caruso, D. R. (2008). Emotional intelligence: New ability or eclectic traits? *American Psychologist, 63*(6), 503–517. https://doi.org/10.1037/0003-066X.63.6.503

Mayer, J. D., Salovey, P., Caruso, D. R., & Sitarenios, G. (2001). Emotional intelligence as a standard intelligence. *Emotion*. https://doi.org/10.1037/1528-3542.1.3.232

McClure, E. B. (2000). A meta-analytic review of sex differences in facial expression processing and their development in infants, children, and adolescents. *Psychological Bulletin, 126*(3), 424–453. https://doi.org/10.1037/0033-2909.126.3.424

McElwain, N. L., Halberstadt, A. G., & Volling, B. L. (2007). Mother- and father-reported reactions to children's negative emotions: Relations to young children's emotional understanding and friendship quality. *Child Development, 78*(5), 1407–1425. https://doi.org/10.1111/j.1467-8624.2007.01074.x

McLaughlin, K. A., Hatzenbuehler, M. L., & Hilt, L. M. (2009). Emotion dysregulation as a mechanism linking peer victimization to internalizing symptoms in adolescents. *Journal of Consulting and Clinical Psychology, 77*(5), 894–904. https://doi.org/10.1037/a0015760

Meltzoff, A. N., & Moore, M. K. (1977). Imitation of facial and manual gestures by human neonates. *Science, 198*(4312), 75–78. https://doi.org/10.1126/science.198.4312.75

Mondloch, C. J. (2012). Sad or fearful? The influence of body posture on adults' and children's perception of facial displays of emotion. *Journal of Experimental Child Psychology, 111*(2), 180–196. https://doi.org/10.1016/j.jecp.2011.08.003

Montagne, B., Kessels, R. P. C., Frigerio, E., De Haan, E. H. F., & Perrett, D. I. (2005). Sex differences in the perception of affective facial expressions: Do men really lack emotional sensitivity? *Cognitive Processing, 6*(2), 136–141. https://doi.org/10.1007/s10339-005-0050-6

Montague, D. P. F., & Walker-Andrews, A. S. (2001). Peekaboo: A new look at infants' perception of emotion expressions. *Developmental Psychology, 37*(6), 826–838. https://doi.org/10.1037//0012-1649.37.6.826

Nelson, C. A. (1987). The recognition of facial expressions in the first two years of life: mechanisms of development. *Child Development, 58*(4), 889–909. https://doi.org/10.2307/1130530

Nelson, C. A., & Dolgin, K. G. (1985). The generalized discrimination of facial expressions by seven-month-old infants. *Child Development, 56*(1983), 58–61. https://doi.org/10.2307/1130173

Nelson, C. A., Morse, P., & Leavitt, L. (1979). Recognition of facial expressions by seven-month-old infants. *Child Development, 50*(4), 1239–1242. https://doi.org/10.2307/1129358

Nelson, N. L., & Russell, J. A. (2016). A facial expression of pax: Assessing children's "recognition" of emotion from faces. *Journal of Experimental Child Psychology, 141*, 49–64. https://doi.org/10.1016/j.jecp.2015.07.016

Neta, M., & Whalen, P. J. (2010). The primacy of negative interpretations when resolving the valence of ambiguous facial expressions. *Psychological Science, 21*(7), 901–907. https://doi.org/10.1177/0956797610373934

Niles, A. N., Craske, M. G., Lieberman, M. D., & Hur, C. (2015). Affect labeling enhances exposure effectiveness for public speaking anxiety. *Behaviour Research and Therapy, 68*, 27–36. https://doi.org/10.1016/j.brat.2015.03.004

Nook, E. C., Lindquist, K. A., & Zaki, J. (2015). A new look at emotion perception: Concepts speed and shape facial emotion recognition. *Emotion, 15*(5), 569–578. https://doi.org/10.1037/a0039166

Nook, E. C., Sasse, S. F., Lambert, H. K., McLaughlin, K. A., & Somerville, L. H. (2017). Increasing verbal knowledge mediates development of multidimensional emotion representations. *Nature Human Behavior, 1*(12), 881.

Nook, E. C., Sasse, S. F., Lambert, H. K., McLaughlin, K. A., & Somerville, L. H. (2018). The nonlinear development of emotion differentiation: Granular emotional experience is low in adolescence. *Psychological Science, 29*(8), 1346–1357.

O'Kearney, R., & Dadds, M. (2004). Developmental and gender differences in the language for emotions across the adolescent years. *Cognition & Emotion, 18*(7), 913–938. https://doi.org/10.1080/02699930341000356

Oakes, L. M. (2010). Using habituation of looking time to assess mental processes in infancy. *Journal of Cognition and Development, 11*(3), 255–268. https://doi.org/10.1080/15248371003699977

Ozanska-Ponikwia, K. (2013). *Emotions from a bilingual point of view*. Newcastle-upon-Tyne: Cambridge Scholars Publishing.

Panayiotou, A. (2004). Switching codes, switching code: Bilinguals' emotional responses in English and Greek. *Journal of Multilingual and Multicultural Development, 25*(2–3), 124–139. https://doi.org/10.1080/01434630408666525

Panicacci, A. (2013). Emotions from a bilingual point of view: personality and emotional intelligence in relation to perception and expression of emotions in the L1 and L2. *International Journal of Bilingual Education and Bilingualism, 17*(6), 727–730. https://doi.org/10.1080/13670050.2013.857505

Pavlenko, A. (2005). Bilingualism and thought. In *Handbook of bilingualism: Psycholinguistic approaches* (pp. 433–453). Oxford: Oxford University Press. https://doi.org/10.1017/S0272263107210071

Pavlenko, A. (2008). Structural and conceptual equivalence in the acquisition and use of emotion words in a second language. *Mental Lexicon, 3*, 91–120.

Pavlenko, A., & Driagina, V. (2007). Russian emotion vocabulary in American learners' narratives. *Modern Language Journal, 91*(2), 213–234. https://doi.org/10.1111/j.1540-4781.2007.00541.x

Peltola, M. J., Leppänen, J. M., Mäki, S., & Hietanen, J. K. (2009). Emergence of enhanced attention to fearful faces between 5 and 7 months of age. *Social Cognitive and Affective Neuroscience, 4*(2), 134–142. https://doi.org/10.1093/scan/nsn046

Pennebaker, J. W., & Stone, L. D. (2003). Words of wisdom: Language use over the life span. *Journal of Personality and Social Psychology*. https://doi.org/10.1037/0022-3514.85.2.291

Perlman, S. B., Camras, L. A., & Pelphrey, K. A. (2008). Physiology and functioning: Parents' vagal tone, emotion socialization, and children's emotion knowledge. *Journal of Experimental Child Psychology, 100*(4), 308–315. https://doi.org/10.1016/j.jecp.2008.03.007

Pons, F., Harris, P. L., & de Rosnay, M. (2004). Emotion comprehension between 3 and 11 years: Developmental periods and hierarchical organization. *European Journal of Developmental Psychology, 1*(2), 127–152. https://doi.org/10.1080/17405620344000022

Pons, F., Lawson, J., Harris, P. L., & De Rosnay, M. (2003). Individual differences in children's emotion understanding: Effects of age and language. *Scandinavian Journal of Psychology, 44*(4), 347–353. https://doi.org/10.1111/1467-9450.00354

Quinn, P. C., Anzures, G., Izard, C. E., Lee, K., Pascalis, O., Slater, A. M., & Tanaka, J. W. (2011). Looking across domains to understand infant representation of emotion. *Emotion Review, 3*(2), 197–206. https://doi.org/10.1177/1754073910387941

Ridgeway, D., Waters, E., & Kuczaj, S. (1985). Acquisition of emotion-descriptive language: Receptive and productive vocabulary norms for ages 18 months to 6 years. *Developmental Psychology, 21*(5), 901–908. https://doi.org/10.1037//0012-1649.21.5.901

Rivers, S. E., Brackett, M., Omori, M., Sickler, C., Bertoli, M. C., & Salovey, P. (2013). Emotion skills as a protective factor for risky behaviors among college students. *Journal of College Student Development, 54*(2), 172–183. https://doi.org/10.1353/csd.2013.0012

Roberson, D., & Davidoff, J. (2000). The categorical perception of colors and facial expressions: The effect of verbal interference. *Memory and Cognition, 28*(6), 977–986.

Roberson, D., Davidoff, J., & Braisby, N. (1999). Similarity and categorisation: neuropsychological evidence for a dissociation in explicit categorisation tasks. *Cognition, 71*(1), 1–42. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10394708

Rosen, H. J., Pace-Savitsky, K., Perry, R. J., Kramer, J. H., Miller, B. L., & Levenson, R. W. (2004). Recognition of emotion in the frontal and temporal variants of frontotemporal dementia. *Dementia and Geriatric Cognitive Disorders, 17*(4), 277–281. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/15178936

Ruba, A. L., Johnson, K. M., Harris, L. T., & Wilbourn, M. P. (2017). Developmental changes in infants' categorization of anger and disgust facial expressions.

Developmental Psychology. https://doi.org/10.1037/dev0000381

Ruba, A. L., & Repacholi, B. (forthcoming). Do infants understand discrete emotions? A review of early emotion concept development. *Emotion Review*.

Russell, J. A. (1990). The preschooler's understanding of the causes and consequences of emotion. *Child Development, 61*(6), 1872–1881. https://doi.org/10.1111/j.1467-8624.1990.tb03571.x

Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review, 110*(1), 145. https://doi.org/10.1037/0033-295X.110.1.145

Russell, J. A., & Bullock, M. (1986a). Fuzzy concepts and the perception of emotion in facial expressions. *Social Cognition, 4*(3), 309–341. https://doi.org/10.1521/soco.1986.4.3.309

Russell, J. A., & Bullock, M. (1986b). On the dimensions preschoolers use to interpret facial expressions of emotion. *Developmental Psychology, 22*, 97–102.

Russell, J. A., & Widen, S. C. (2002). Words versus faces in evoking preschool children's knowledge of the causes of emotions. *International Journal of Behavioral Development, 26*(2), 97–103. https://doi.org/10.1080/01650250042000582

Saarni, C., Campos, J. J., Camras, L. A., & Witherington, D. (2006). Emotional development: Action, communication, and understanding. In W. Damon, R.M. Lerner & N. Eisenberg (Eds.) *Handbook of Child Psychology: Social, emotional, and personality development* (pp. 226–299). Hoboken, NJ: John Wiley & Sons Inc.

Salmon, K., O'Kearney, R., Reese, E., & Fortune, C.-A. (2016). The role of language skill in child psychopathology: Implications for intervention in the early years. *Clinical Child and Family Psychology Review, 19*(4), 352–367. https://doi.org/10.1007/s10567-016-0214-1

Satpute, A. B., Kang, J., Bickart, K. C., Yardley, H., Wager, T. D., & Barrett, L. F. (2015). Involvement of sensory regions in affective experience: A meta-analysis. *Frontiers in Psychology, 6*(DEC), 1–14. https://doi.org/10.3389/fpsyg.2015.01860

Satpute, A. B., Shu, J., Weber, J., Roy, M., & Ochsner, K. N. (2013). The functional neural architecture of self-reports of affective experience. *Biological Psychiatry*, *73*(7), 631–638. doi: https://doi.org/10.1016/j.biopsych.2012.10.001S0006-3223(12)00855-4 [pii]

Schwartz, G. M., Izard, C. E., & Ansul, S. E. (1985). The 5-month-old's ability to discriminate facial expressions of emotion. *Infant Behavior and Development, 8*(1), 65–77. https://doi.org/10.1016/S0163-6383(85)80017-5

Serrano, J. M., Iglesias, J., & Loeches, A. (1992). Visual discrimination and recognition of facial expressions of anger, fear, and surprise in 4- to 6-month-old infants. *Developmental Psychobiology, 25*(6), 411–425. https://doi.org/10.1002/dev.420250603

Serrano, J. M., Iglesias, J., & Loeches, A. (1995). Infants' responses to adult static facial expressions. *Infant Behavior and Development, 18*(4), 477–482. https://doi.org/10.1016/0163-6383(95)90036-5

Shablack, H., Lindquist, K. A., & Becker, M. (under review). How do children learn novel emotion words? A study of emotion concept acquisition in preschoolers.

Siegel, E. H., Sands, M. K., Van den Noortgate, W., Condon, P., Chang, Y., Dy, J., … Barrett, L. F. (2018). Emotion fingerprints or emotion populations? A meta-analytic investigation of autonomic features of emotion categories. *Psychological Bulletin, 144*(4), 343–393. https://doi.org/10.1037/bul0000128

Silvers, J., McRae, K., Gabrieli, J. D. E., Gross, J. J., Remy, K., & Ochsner, K. N. (2012). Age-related differences in emotional reactivity, regulation, and rejection sensitivity in adolescence. *Emotion, 12*(6), 1235–1247. https://doi.org/10.1037/a0028297

Slater, A. M. (2002). Visual perception in the newborn infant: Issues and debates. *Intellectica, 34*, 57–76.

Somerville, L. H., Jones, R. M., & Casey, B. J. (2010). A time of change: Behavioral and neural correlates of adolescent sensitivity to appetitive and aversive environmental cues. *Brain and Cognition*. https://doi.org/10.1016/j.bandc.2009.07.003

Somerville, L. H., & Whalen, P. J. (2006). Prior experience as a stimulus category confound: an example using facial expressions of emotion. *Social Cognitive and Affective Neuroscience, 1*(3), 271–274. https://doi.org/10.1093/scan/nsl040

Sullivan, M. W., Carmody, D. P., & Lewis, M. (2010). How neglect and punitiveness influence emotion knowledge. *Child Psychiatry and Human Development, 41*(3), 285–298. https://doi.org/10.1007/s10578-009-0168-3

Taumoepeau, M., & Ruffman, T. (2006). Mother and infant talk about mental states relates to desire language and emotion understanding. *Child Development, 77*(2), 465–481. https://doi.org/10.1111/j.1467-8624.2006.00882.x

Taumoepeau, M., & Ruffman, T. (2008). Stepping stones to others' minds: Maternal talk relates to child mental state language and emotion understanding at 15, 24, and 33 months. *Child Development, 79*(2), 284–302. https://doi.org/10.1111/j.1467-8624.2007.01126.x

Toppelberg, C. O., Medrano, L., Morgens, L. P., & Nieto-Castañon, A. (2002). Bilingual children referred for psychiatric services: Associations of language disorders, language skills, and psychopathology. *Journal of the American Academy of Child and Adolescent Psychiatry, 41*(6), 712–722. https://doi.org/10.1097/00004583-200206000-00011

Tronick, E. Z. (1989). Emotions and emotional communication in infants. *American Psychologist, 44*(2).

Tsai, J. L., Louie, J. Y., Chen, E. E., & Uchida, Y. (2007). Learning what feelings to desire: Socialization of ideal affect through children's storybooks. *Personality and Social Psychology Bulletin, 33*(1), 17–30. https://doi.org/10.1177/0146167206292749

Turati, C., Montirosso, R., Brenna, V., Ferrara, V., & Borgatti, R. (2011). A smile enhances 3-month-olds' recognition of an individual face. *Infancy, 16*(3), 306–317. https://doi.org/10.1111/j.1532-7078.2010.00047.x

Twenge, J. M., Catanese, K. R., & Baumeister, R. F. (2003). Social exclusion and the deconstructed state: time perception, meaninglessness, lethargy, lack of emotion, and self-awareness. *Journal of Personality and Social Psychology, 85*(3), 409–423. https://doi.org/10.1037/0022-3514.85.3.409

Vinden, P. G. (1999). Children's understanding of mind and emotion: A multi-culture study. *Cognition and Emotion, 13*(1), 19–48. https://doi.org/10.1080/026999399379357

Visser, M., Jefferies, E., & Lambon Ralph, M. A. (2010). Semantic processing in the anterior temporal lobes: A meta-analysis of the functional neuroimaging literature. *Journal of Cognitive Neuroscience, 22*(6), 1083–1094. Retrieved from http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=19583477

Walker-Andrews, A. S. (1997). Infants' perception of expressive behaviors: Differentiation of multimodal information. *Psychological Bulletin, 121*(3), 437–456. https://doi.org/10.1037/0033-2909.121.3.437

Wellman, H. M., Harris, P. L., Banerjee, M., & Sinclair, A. (1995). Early understanding of emotion: Evidence from natural language. *Cognition and Emotion, 9*(2–3), 117–149. https://doi.org/10.1080/02699939508409005

Whalen, P. J. (2007). The uncertainty of it all. *Trends in Cognitive Sciences, 11*(12), 499–500.

Whalen, P. J., Kagan, J., Cook, R. G., Davis, F. C., Kim, H., Polis, S., … Johnstone, T. (2004). Human amygdala responsivity to masked fearful eye whites. *Science (New York, N.Y.), 306*(5704), 2061. Retrieved from http://www.ncbi.nlm.nih.gov.ezp-prod1.hul.harvard.edu/pubmed/15604401

Widen, S. C. (2013). Children's interpretation of facial expressions: The long path from valence-based to specific discrete categories. *Emotion Review, 5*, 72–77.

Widen, S. C., Pochedly, J. T., & Russell, J. A. (2015). The development of emotion concepts: A story superiority effect in older children and adolescents. *Journal of Experimental Child Psychology, 131*, 186–192. https://doi.org/10.1016/j.jecp.2014.10.009

Widen, S. C., & Russell, J. A. (2003). A closer look at preschoolers' freely produced labels for facial expressions. *Developmental Psychology, 39*(1), 114–127.

Widen, S. C., & Russell, J. A. (2008a). Young children's understanding of others' emotions. In J. M. Haviland-Jones, M. Lewis, & L. F. Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 348–363). New York: Guilford.

Widen, S. C., & Russell, J. A. (2008b). Children's and adults' understanding of the "disgust face". *Cognition and Emotion, 22*(8), 1513–1541. https://doi.org/10.1080/02699930801906744

Widen, S. C., & Russell, J. A. (2008c). Children acquire emotion categories gradually. *Cognitive Development, 23*(2), 291–312. https://doi.org/10.1016/j.cogdev.2008.01.002

Widen, S. C., & Russell, J. A. (2013). Children's recognition of disgust in others. *Psychological Bulletin, 139*(2), 271–299. https://doi.org/10.1037/a0031640

Wong, M. S., McElwain, N. L., & Halberstadt, A. G. (2009). Parent, family, and child characteristics: Associations with mother- and father-reported emotion socialization practices. *Journal of Family Psychology, 23*(4), 452–463. https://doi.org/10.1037/a0015552

Xu, F. (2002). The role of language in acquiring object kind concepts in infancy. *Cognition, 85*(3), 223–250. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12169410

Yew, S. G. K., & O'Kearney, R. (2013). Emotional and behavioural outcomes later in childhood and adolescence for children with specific language impairments: Meta-analyses of controlled prospective studies. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 54*(5), 516–524. https://doi.org/10.1111/jcpp.12009

Young-Browne, G., Rosenfeld, H. M., & Horowitz, F. D. (1977). Infant discrimination of facial expressions. *Child Development, 48*(2), 555–562. https://doi.org/10.2307/1128653

Emotion Understanding and Regulation: Implications for Positive School Adjustment

Sarah R. Bardack and Sherri C. Widen

Abstract

Traditionally, research on school readiness and of academic success has focused on children's performance in reading, math, and other subjects. However, there is ample evidence that children's social and emotional skills are important to children's positive school adjustment and support their acquisition of academic skills as well. In this chapter, we explore the significant role of two emotion processes—emotion understanding and emotion regulation—in shaping children's academic and social success in school. First, we provide definitions and conceptual backgrounds for the terms emotion understanding and emotion regulation. Second, we summarize the empirical literature examining these emotion processes in relation to children's academic and social adjustment in school, parents' role in children's acquisition of these skills, and interventions that increase children's social-emotional skills. We end by identifying new directions for future research to address gaps in current literature to advance our understanding of how these important processes contribute to children's positive school adjustment.

S. R. Bardack
Imagine Worldwide, San Francisco, CA, USA

S. C. Widen (✉)
Committee for Children, Seattle, WA, USA

Children's understanding and regulation of emotions have implications for their academic and social competence in school. A wide array of research, concentrated in the preschool years, has shown that children's ability to understand and empathize with others' feelings and regulate their own emotional expression is critical for navigating the academic and social demands of early school environments (Curby, Brown, Bassett, & Denham, 2015; Denham et al., 2012; Shields et al., 2001). Indeed, the ability to understand and control emotions is considered an important marker of school readiness with implications for children's academic and social trajectories through school (Blair, 2002; Denham, 2006). While less work has examined the role of emotion understanding and regulation in promoting children's adaptive functioning beyond elementary school (Kwon, Hanrahan, & Kupzyk, 2017), these processes likely continue to be relevant for school success through college.

In this chapter, we first provide definitions and conceptual backgrounds for the terms emotion understanding and emotion regulation. Since emotion understanding and emotion regulation are the two components of emotion that are most commonly examined in relation to children's school success, the current chapter focuses on these two facets of children's emotion development. While other work has examined how distinct, yet related emotion skills (e.g., expressions of emotion, observed emotional behavior;

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_19

Hernández et al., 2015; Herndon, Bailey, Shewark, Denham, & Bassett, 2013) relate to children's academic and social functioning in school, these measures of emotional development were too disparate to incorporate succinctly. Second, we summarize the empirical literature examining these emotion processes in relation to children's academic and social adjustment in school. Third, we explore intervention work intended to promote different facets of children's emotional competence in the family and school contexts. Finally, we identify new directions for future research to address gaps in current literature to advance our understanding of how these important processes contribute to children's positive school adjustment.

Emotion Understanding and Emotion Regulation: Definition and Conceptual Background

Development of Children's Understanding of Emotion

Children's understanding of emotion develops gradually throughout childhood and even into adolescence and adulthood. Although children begin using emotion words as early as 18 months (Bretherton et al., 1981), their understanding of these words is very different from adults'. Initially, children understand emotions and emotion words in terms of valence (feels good vs. feels bad; Widen, 2013, 2016; Widen & Russell, 2003, 2008). For infants and toddlers, anger, fear, sadness, embarrassment, shame, and so on are all a part of one category (feels bad); happiness, excitement, calm, and so on are a part of another (feels good). The developmental challenge is to differentiate within these broad valence-based categories until the adult taxonomy of emotions is acquired.

This process of differentiation begins when children begin to link the components of emotion concepts (causes, consequences, behaviors, facial expressions, labels, etc.; Widen, 2013, 2016, Widen & Russell, 2004, 2008). Through this process, children learn that some negative emotions are caused by a loss (sadness), whereas others result in aggression (anger; Widen, 2013). Thus, infants can understand a parent's facial expression, behavior, and vocalizations as positive or negative and use that information to decide whether to approach (positive emotion) or withdraw (negative emotion) from a novel situation (Klinnert, Emde, Butterfield, & Campos, 1986; Moses, Baldwin, Rosicky, & Tidball, 2001; Walden & Kim, 2005).

This valence-based understanding is still the basis of emotion understanding in 2-year-olds. For example, when 2-year-olds were asked to sort facial expressions into and out of the angry category (presented as an "angry box"), they excluded happiness expressions but included all the negative expressions (Russell & Widen, 2002a; Widen & Russell, 2008). This valence-based pattern occurs on other sorting tasks (Bullock & Russell, 1984, 1985) and when children are asked to freely label facial expressions (Widen & Russell, 2003). This broad negative emotion category begins to narrow as children get older. Children 3 years and older were less likely to include sadness expressions in the angry box, and about half of children up to 6 years excluded the fear expressions; at all ages (2–7 years) children included the disgust expression as often as the anger expression indicating that they had not yet differentiated these two expressions. The same gradual narrowing of the negative emotion category is observed on other tasks such as free labeling facial expressions and emotion situations (Widen & Russell, 2003, 2008, 2010a, 2010b).

Differentiation follows a predictable pattern. When children are asked to freely label facial expressions, for example, the majority of 2-year-olds label only the happiness face as predicted (i.e., calling the happiness face happy or some close synonym); 3-year-olds also label the anger and sadness faces as predicted; 5-year-olds, the surprise face; 6-year-olds, the fear face; and not until 9 years do about half of children label the disgust face as disgusted (Widen, 2013, 2016, 2017). Similar patterns are observed when children label emotion situations (Widen & Russell, 2010a, 2010b), postures (Nelson & Russell, 2011), and in other

languages and cultures (Kayyal, Widen, & Russell, 2018; Massarani, Gosselin, Montembeault, Gagnon, & Suurland, 2011).

The components of emotions (e.g., causes, consequences, behaviors, facial expressions, vocalizations, and so on) unfold over time and in a predictable sequence. Children bring all the components together like pieces of a puzzle to decide how the other is feeling. Indeed, in day-to-day experience, it would be rare for a child to see only a facial expression or only the cause of an emotion. The component that is most helpful to children in helping them make that decision varies from emotion to emotion. The cause may be the first component for some emotions, consequences for others, and labels for yet others. That is, there is no one component that serves as the toe-hold for the differentiation of all emotion categories. For example, although facial expressions are an externally observable component of emotions, these are not the component that children first associate with most specific emotion categories (Balconi & Carrera, 2007; Camras & Allison, 1985; Nelson, Hudspeth, & Russell, 2013; Russell & Widen, 2002b; Smith & Walden, 1999; Widen & Russell, 2004, 2010a, 2010b). Instead, when given the label or consequence, even 3-year-olds were better able to describe the causes of an emotion than when given a facial expression (Widen & Russell, 2004).

Development of Children's Emotion Regulation

So far, we have focused on children's understanding of emotions in others. Another important socioemotional skill is emotion regulation—the management of one's own emotions. While the two are related, they are not entirely overlapping. Understanding emotions witnessed in another may be a "colder" process than understanding one's own emotions.

Emotion regulation is multifaceted, comprising a diffuse network of processes that have physiological, cognitive, and behavioral bases (Eisenberg, Spinrad, & Eggum, 2010; Eisenberg & Sulik, 2012; Thompson, Lewis, & Calkins, 2008). It is most commonly viewed as an integrative process involving attention and cognition (Blair, 2002; Thompson et al., 2008; Ursache, Blair, & Raver, 2012). It is defined as the process through which individuals modulate emotional responses according to situational demands in order to achieve goals (Eisenberg et al., 2010; Thompson et al., 2008). Further, it has been proposed that emotion regulation processes can either facilitate and organize or disrupt other psychological processes (e.g., attention focusing, problem solving) in ways that can either promote or undermine academic and social competence (Cole, Martin, & Dennis, 2004).

From infancy onward, emotion regulation skills develop in concert with other emerging abilities (language, executive functioning; Eisenberg et al., 2005; Fox & Calkins, 2003; Ursache et al., 2012). As such, most models of children's emotional development posit bidirectional influences between the development of children's emotional, behavioral, and cognitive processes. Beginning in infancy, emotion regulation is influenced by children's early physiological and behavioral responses to environmental stimuli and regulation of attention. For example, infants initially modulate arousal by redirecting their attention to disengage from emotionally arousing stimuli (Posner & Rothbart, 2000; Thompson et al., 2008). During the toddler and preschool years, children become increasingly independent in their emotion regulation skills and also continue to gain mastery over their behavioral and attentional control (Eisenberg et al., 2005; Fox & Calkins, 2003). In middle childhood and beyond, growth in executive function skills (inhibitory control, working memory, and cognitive flexibility), theory of mind, emotion understanding, and social awareness aids children's increasing emotion regulation (Thompson et al., 2008; Zelazo & Cunningham, 2007).

Parents' Role in Children's Acquisition of Emotion Understanding and Regulation Skills

Parents, of course, play a prominent role in shaping children's emotion understanding and emotion regulation skills. Here, we focus on two key mechanisms through which parents influence children's acquisition of emotion understanding and regulation skills: (1) parent-child relationship; and (2) parent emotion socialization, as indexed by parents' ability to model emotion understanding and regulation and to discuss and respond to their children's emotional expressions.

Parents influence the development of children's emotion understanding and regulation skills through a wide variety of emotion socialization strategies. These strategies include modeling and discussing emotions as well as the quality of their responses to their children's emotional expression (Denham & Kochanoff, 2002; Eisenberg, Cumberland, & Spinrad, 1998; Gottman, Katz, & Hooven, 1996). Parents who are better at regulating their own emotions may also be better at discussing and labeling their children's emotional expression (Crandall, Deater-Deckard, & Riley, 2015; Gottman et al., 1996; Morelen, Shaffer, & Suveg, 2016). Parents who respond to their children's emotional expression in warm, sensitive, and constructive ways are also more likely to have children with better emotion understanding and regulation skills (Eisenberg et al., 1998; McElwain, Halberstadt, & Volling, 2007). The way that mothers teach their children about emotions mediates the effectiveness of the mothers' positive expression of emotions and reactions on the emotion knowledge of toddlers (Denham & Kochanoff, 2002). Conversely, parent emotion socialization practices that are overly harsh, punitive, or dismissive of children's emotional expression have been consistently shown to relate to lower levels of emotion regulation in children (Eisenberg et al., 1998; McElwain et al., 2007). Thus, parents' emotion socialization practices lay the groundwork for their children's socioemotional learning and ongoing development.

Much research has established that children develop emotion-related skills in the context of their relationship with their parents (Calkins, 2011; Fox & Calkins, 2003; Mathis & Bierman, 2015; Morris, Criss, Silk, & Houltberg, 2017). Parents who are warm, sensitive, and responsive to their children's needs serve as emotional co-regulators throughout early childhood (Calkins, 2011; Calkins & Hill, 2007). Children of these parents are more likely to internalize emotion regulation strategies that can help them cope with strong emotions (i.e., anger, frustration, happiness, and sadness) independently from their caregivers (Dennis, 2006). There are robust empirical links between warm, sensitive parenting and emerging emotion regulation skills during infant and toddler years (Calkins & Marcovitch, 2010). Similarly, a meta-analytic review found a medium-sized significant effect for the association between secure attachment relations (in which caregivers consistently respond to children's range of emotional expression without selectively responding to positive or negative emotions) and children's emotion understanding (Cooke, Stuart-Parrigon, Movahed-Abtahi, Koehn, & Kerns, 2016).

Emotion Understanding and Regulation as Predictors of Positive School Adjustment

Children's emotion understanding and regulation skills represent important predictors of children's school readiness and subsequent academic and social adjustment in school (Blair, 2002; Denham, 2006; Trentacosta & Izard, 2007; Ursache et al., 2012). Children with strong emotion understanding make and keep friends more easily, get better grades, and have fewer behavior problems than children with weak emotion understanding (Alexander, Entwisle, & Dauber, 1993; McClelland, Morrison, & Holmes, 2000). Emotion understanding contributes to emotion regulation, which is related to diverse classroom outcomes (as discussed below; Bronson, 1994; Cooper & Farran, 1988; Foulks & Morrow, 1989; Stack, Serbin, Enns, Ruttle, & Barrieau, 2010).

Thus, early emotion understanding may lay the groundwork for other skills that are important for social and academic success.

Children with weak emotion regulation skills who regulate their emotion through reactive means (e.g., withdrawal, vigilance in response to anxiety) have more difficulty exhibiting control over arousal and attention that is necessary for learning to occur. Emotion regulation skills allow students to harness the motivation provided by positive emotions, such as interest, in order to attend to academic tasks (Izard, 1991). Further, emotion regulation skills facilitate the positive interactions with teachers and peers that can promote school engagement and impact children's academic motivation (Denham, 2006; Eisenberg et al., 2005).

Empirical work supports the importance of emotion understanding and regulation in predicting a wide array of children's socioemotional and academic outcomes (Graziano, Reavis, Keane, & Calkins, 2007; Howse, Calkins, Anastopoulos, Keane, & Shelton, 2003; Shields et al., 2001; Trentacosta & Fine, 2010; Trentacosta & Izard, 2007). Research, concentrated on preschool-aged children, has shown that emotion understanding and regulation uniquely relate to teacher-rated classroom adjustment including social skills, motivation to learn, behavioral regulation (Denham et al., 2012; Denham, Bassett, Brown, Way, & Steed, 2015; Garner & Waajid, 2008; Miller et al., 2006; Shields et al., 2001), and early academic achievement (Curby et al., 2015; Leerkes, Paradise, O'Brien, Calkins, & Lange, 2008).

Beyond preschool, robust associations have been established between emotion regulation and children's academic achievement in kindergarten and first grade (Blankson et al., 2017; Graziano et al., 2007; Howse et al., 2003; Trentacosta & Izard, 2007). Children who were better at regulating their emotions also had higher levels of academic motivation, engagement, and achievement in elementary school (Kwon et al., 2017). Similarly, emotion understanding has been shown to predict children's academic outcomes in kindergarten (Blankson et al., 2017; Izard et al., 2001) and longitudinally for 4 years (Izard et al., 2001). Further, a meta-analysis found that emotion understanding is a consistent correlation of social competence across childhood and adolescence (Trentacosta & Fine, 2010).

Researchers have taken different approaches to examining how separate emotion processes relate to children's positive school adjustment. Some have focused on a single emotion processing skill, such as emotion regulation (Graziano et al., 2007; Howse et al., 2003; Kwon et al., 2017; Miller et al., 2006; Trentacosta & Izard, 2007) or emotion understanding (Denham, Bassett, Zinsser, & Wyatt, 2014; Garner & Waajid, 2008; Izard et al., 2001). Others have focused on the independent contributions of both emotion understanding and regulation in predicting school outcomes (Curby et al., 2015; Leerkes et al., 2008; Shields et al., 2001).

Other work has gone beyond direct prediction of positive school adjustment from emotion understanding and regulation and examined how these emotion processes function in concert with each other and with other attentional and behavioral indices. For example, emotion understanding relates to classroom adjustment (Denham et al., 2015) only through its contribution to social competence, whereas emotion regulation has been shown to mediate the association between emotion understanding and social competence (Di Maggio, Zappulla, & Pace, 2016). Other research has illustrated how behavioral self-regulation (Howse et al., 2003) and emotion regulation facilitate relations between emotion regulation and teacher ratings of kindergarten achievement (Trentacosta & Izard, 2007). Work exploring mediational pathways between emotion understanding and regulation and other socioemotional skills found that the executive functioning of both processes indirectly relates to reading achievement and teacher-reported school performance (Blankson et al., 2017). Further, emotion regulation has been shown to be indirectly associated via motivation with academic achievement (Kwon et al., 2017).

By comparison, there is less research examining the associations between emotion processes and positive school adjustment for different subgroups of the school population. Most work has

focused on the role of emotion processes in relation to early school outcomes for at-risk preschool children (Cunningham, Kliewer, & Garner, 2009; Denham et al., 2012; Miller et al., 2006; Shields et al., 2001). Emotion knowledge may represent a protective factor for older children and boys (Denham et al., 2012). To our knowledge, only one study has examined the association between emotion regulation and academic outcomes (i.e., school adjustment, learning difficulties, vocabulary, and math) for different subgroups (Barbarin, 2013). The study found that emotion regulation was related to both vocabulary and mathematics outcomes for white boys, only mathematics for black boys, and was not associated with academic outcomes for Latino boys. More work is needed to further explore how emotion processes may relate to school outcomes for children from different race/ethnic groups, as well as extend the current literature by exploring linguistic backgrounds.

Promoting Emotional Development in Family and School Contexts

While there is variance in children's socioemotional skills at every age, these skills can be improved through both parenting and school interventions. Such interventions seek to change parenting practices or school climate in addition to providing direct instruction to the child via parents or teachers. For parenting interventions, the most successful approaches provide support over a long period of time vs. short, intensive interventions (York, Loeb, & Doss, 2017). For school interventions, the most successful interventions share four elements (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011): a sequenced set of activities, active forms of learning, at least one component that focuses on developing personal or social skills, and targeted social-emotional skills. School interventions that are implemented well by teachers are successful in increasing students' socioemotional skills; programs that are poorly implemented or implemented by nonschool facilitators are not (Durlak et al., 2011; Espelage, Polanin, & Low, 2014).

Parenting Interventions to Promote School Readiness

Virtually all parents want their children to succeed in school (Stevenson, Chen, & Uttal, 1990), yet some parents provide their children with comparatively more support. For example, from birth to age 2, higher-income children are more likely than lower-income children to be caressed, kissed, or hugged by their mother, and they are less likely to be spanked (Bradley, Corwyn, McAdoo, & García Coll, 2001). Higher-income infants and toddlers also have greater access to children's books and are more likely to be read to than their lower-income counterparts (Hart & Risley, 1995). These disparities have significant consequences, as children who experience responsive and stimulating parental care tend to score higher on assessments of motor, social, emotional, literacy, and numeracy skills than those who do not (Bradley et al., 2001; Melhuish et al., 2008; NICHD Early Child Care Research Network, 2006). Skill gaps that develop early in life are difficult to overcome and have significant negative implications for later life economic outcomes (Heckman, 2006).

Substantial effort has gone into developing interventions to improve parents' practices. Parenting workshops have typically taken two approaches: social learning or emotion socialization. Social learning is the most common approach and is used in Triple P (Sanders, Markie-Dadds, Tully, & Bor, 2000), Parent Management Training (Pearl, 2009), and the Incredible Years (Webster-Stratton, Jamila Reid, & Stoolmiller, 2008). These programs focus on increasing parents' positive reinforcement of children's good behaviors and decreasing reinforcement and punishment of bad behaviors. The central idea is that, by reinforcing children's good behaviors, children will be more likely to repeat those behaviors and less likely to repeat the now unreinforced bad behaviors. For example, parents are encouraged to praise children when they are playing quietly or following instructions and to also ignore minor bad behaviors with a readiness to praise the next good behavior.

In contrast, parenting interventions such as "Tuning in to Kids" (Havighurst, Wilson, Harley, Prior, & Kehoe, 2010) take an emotion socialization approach. These interventions address parents' own emotion regulation and expression, their reactions to children's emotions, emotion coaching, and discussion of emotions. The underlying assumption is that increasing parents' and children's knowledge of how to express and regulate emotions provides the basis for the development of prosocial behavior and social relationships (Havighurst et al., 2010; Trentacosta & Fine, 2011; Trentacosta & Shaw, 2009).

Some social learning and emotion socialization approaches have shown positive effects on children's behavior and the parent-child relationship (Havighurst et al., 2010; Sanders, 1999; Webster-Stratton et al., 2008). However, workshops used to educate parents may be an inefficient approach: Workshops try to quickly change complex parenting behaviors through a short series of time-intensive parenting workshops (Duncan, Ludwig, & Magnuson, 2010). This lack of effectiveness is not surprising given that parenting is a difficult task that requires long-term attention, many decisions every day, and that people are typically resistant to change even when they seek advice (Brehm & Brehm, 1981; Mullainathan & Thaler, 2000; Thaler & Sunstein, 2008). Indeed, workshops may increase these factors by placing significant demands on parents' time and inundating them with information. In addition, compared to higher-income parents, low-income and minority parents who may benefit most from a parenting intervention are less likely to attend these kinds of workshops (Prinz & Miller, 1994).

A new, soft-touch parenting intervention capitalizes on the ubiquity of text messages. The power of text messaging interventions lies in the high open rate of text messages (97% vs. 30% for emails; Ehrlich, 2013) and the ability to send text messages with information and activities over a long period of time (e.g., the school year). A text messaging parenting intervention developed at Stanford University was designed to help parents support their preschoolers' early literacy, math, and socioemotional skills. In a randomized control trial (RCT) focused on at-home literacy activities, families in the treatment group received three texts each week for 7 months (York et al., 2017). After the intervention, compared to the control group, parents in the treatment group reported doing more at-home literacy activities and their children were ahead by 2–3 months of learning in some areas of literacy.

This intervention has now been adapted to focus on children's socioemotional skills and positive parenting (e.g., naming emotions, identifying their causes and consequences, building emotion regulation, perseverance, sharing, turn-taking, and positive parenting techniques for reinforcing good behaviors and changing bad ones) and includes both social learning and emotion socialization approaches. In a pilot study of this curriculum, parents of 3-year-olds received the text messages for 8 months (Widen, Bardack, Jang, & Loeb, 2017). They reported enjoying the texts and activities and reported engaging in the activities with their children. As part of the pilot study, direct assessments were conducted to measure children's socioemotional skills (labeling facial expressions, labeling a character's emotion from a brief story, impulse control, and executive function). We are now following this sample forward to assess how their socioemotional development relates to the acquisition of early literacy and math skills. Our hypothesis is that children who had stronger socioemotional skills at the end of Year 1 will also acquire academic skills more readily, thereby placing them in better stead to succeed in school.

School-Based Interventions

In recent years, there has been a proliferation of school-based interventions designed to promote children's social-emotional learning in schools (Durlak et al., 2011; Jones & Doolittle, 2017). While these interventions vary widely in terms of specific socioemotional focus, relatively few focus specifically on promoting students' emotion-related skills. Here, we highlight evidence from three programs with the strongest focus on emotion processes, namely, the PATHS

(Promoting Alternative Thinking Strategies; Greenberg, Kusche, Cook, & Quamma, 1995), RULER (Recognizing, Understanding, Labeling, Expressing and Regulating; Hagelskamp, Brackett, Rivers, & Salovey, 2013), and Second Step (Committee for Children, 2016) interventions. The PATHS curriculum is designed to reduce aggression and behavior problems by promoting children's socioemotional competence, with a focus on emotion understanding and expression, as well as emotion regulation, empathy, and perspective taking (Greenberg et al., 1995). Evaluations of the PATHS program have linked exposure to the curriculum to gains in children's emotion understanding and regulation skills in preschool and elementary school classrooms (Domitrovich, Cortes, & Greenberg, 2007; Fishbein et al., 2016; Greenberg et al., 1995).

The RULER intervention focuses largely on promoting emotional intelligence in PreK through eighth grade students, as well as supporting adults in creating an emotionally supportive climate for students (Brackett et al., 2009). The intervention integrates skill-building lessons and tools that are designed to foster both teachers' and students' emotional intelligence skills. A randomized controlled trial evaluation of RULER found that students in the intervention group showed improved emotion understanding and regulation when teachers received high quality training and when students received sufficient dosage of the intervention (Reyes, Brackett, Rivers, Elbertson, & Salovey, 2012). Further, classrooms using RULER had higher levels of warmth and connectedness between teachers and students compared to classrooms in the control condition (Rivers, Brackett, Reyes, Elbertson, & Salovey, 2013). These studies provide initial support for the overall effect of providing teachers with training in and teaching practices for promoting students' emotion-related skills.

Second Step is a classroom-level intervention that focuses on directly teaching students' executive function, skills for learning, emotion regulation, and social problem-solving skills in Pre-K through middle school (Committee for Children, 2015). A meta-analysis of 27 studies conducted over the history of the Second Step Program found significant effects on students' knowledge and attitudes about violence and violence prevention but not on prosocial or antisocial behavior (Moy, Polanin, McPherson, & Phan, 2018). In addition, the program was more effective for young elementary school than middle school students. A randomized control trail study of kindergarten, Grade 1, and Grade 2 students participating in the most recent version of Second Step (version 4) found that in classrooms in which Second Step was well implemented (including student engagement and dosage), students' reading and classroom behavior were improved compared to control classrooms (Cook et al., 2018).

Conclusion

Substantial theoretical and empirical work supports the significant role of emotion understanding and regulation in shaping children's school success. However, since most research has focused on preschool-aged children, we know little about how these emotion processes predict different domains of children's school functioning in elementary school and beyond. These emotion processes likely influence how children navigate the academic and social demands in middle childhood and adolescence. There is a clear need for more research linking different emotion processes to school outcomes for older children and young adults, as well as exploring how changes in emotion understanding and regulation relate to children's adaptation to school over time.

Researchers have varied considerably in their approach to examining how emotion understanding and regulation contribute to positive school adjustment, either separately or in conjunction with attentional and behavioral processes. While this work has advanced our understanding of the interrelation of emotion, attention, and behavior in relation to school functioning, more coherence and consistency across studies are needed in order to draw conclusions about how these processes work together in influencing academic and social competence. In addition, there is a lack of

research examining how emotion understanding and regulation relate to positive school adjustment for different subpopulations of children. For example, children who have been exposed to higher levels of contextual risk have been shown to demonstrate lower levels of emotional self-regulation (Lengua, 2002; Raver, 2004), which places them on a higher risk for long-term school maladjustment (Raver, 2003). We also know that parents' emotion socialization strategies can differ based on culture and ethnicity backgrounds in ways that relate to their children's emotional, academic, and social development (Nelson et al., 2013; Perez Rivera & Dunsmore, 2011). While parents also socialize children's emotion differently depending on their gender, we know little about how these differences relate to their ability to understand and regulate emotional expression in school. The evidence across studies is mixed: some studies report small or no influence of gender on young children' emotion recognition skills (Brown & Dunn, 1996; Denham, Zoller, & Couchoud, 1994), while others show that the association between emotion recognition and social competence is stronger for boys in preschool (Parker, Mathis, & Kupersmidt, 2013). Thus, future research could explore variations in the associations between these emotion processes and school outcomes based on factors such as gender and socioeconomic risk, as well as racial/ethnic and linguistic diversity.

Finally, intervention work has shown the positive effects of parenting practices and school-based curricula in broadly promoting children's academic and socioemotional development. Since few parenting or school-based interventions explicitly target the development of emotion understanding and regulation, less is known about how parenting or teaching practices foster these emotion skills in children. More interventions should explicitly focus on the emotion socialization strategies that adults can employ in the home and in school to support the development of emotion skills known to help students thrive in school environments.

Acknowledgments This research was supported by funding from the Silver Giving, Spencer Foundation, Arnold Foundation, and the Evelyn and Walter Haas, Jr. Fund. The authors would like to thank Christina Huber and Madeline Bradshaw for helping with the literature review and Erika Byun and Rocio Hernandez for their careful review and input on the manuscript.

References

Alexander, K. L., Entwisle, D. R., & Dauber, S. L. (1993). First grade classroom behavior: Its short-and long-term consequences for school performance. *Child Development, 64*(3), 801–814. https://doi.org/10.1111/j.1467-8624.1993.tb02944.x

Balconi, M., & Carrera, A. (2007). Emotional representation in facial expression and script: A comparison between normal and autistic children. *Research in Developmental Disabilities, 28*(4), 409–422. https://doi.org/10.1016/j.ridd.2006.05.001

Barbarin, O. (2013). A longitudinal examination of socio-emotional learning in African American and Latino boys across the transition from pre-K to kindergarten. *The American Journal of Orthopsychiatry, 83*(2 Pt 3), 156–164. https://doi.org/10.1111/ajop.12024

Blair, C. (2002). School readiness: Integrating cognition and emotion in a neurobiological conceptualization of children's functioning at school entry. *American Psychologist, 57*(2), 111–127. https://doi.org/10.1037//0003-066X.57.2.111

Blankson, A. N., Weaver, J. M., Leerkes, E. M., O'Brien, M., Calkins, S. D., & Marcovitch, S. (2017). Cognitive and emotional processes as predictors of a successful transition into school. *Early Education and Development, 28*(1), 1–20. https://doi.org/10.1080/10409289.2016.1183434

Brackett, M. A., Patti, J., Stern, R., Rivers, S. E., Elbertson, N. A., Chisholm, C., & Salovey, P. (2009). A sustainable, skill-based approach to building emotionally literate schools. In *Handbook for developing emotional and social intelligence: Best practices, case studies, and strategies* (pp. 329–358). San Francisco, CA: Pfeiffer.

Bradley, R. H., Corwyn, R. F., McAdoo, H. P., & García Coll, C. (2001). The home environments of children in the United States part I: Variations by age, ethnicity, and poverty status. *Child Development, 72*(6), 1844–1867. http://www.jstor.org/stable/3654383?seq=1#page_scan_tab_contents

Brehm, S. S., & Brehm, J. W. (1981). *Psychological reactance: A theory of freedom and control*. New York, NY: Academic Press.

Bretherton, I., Bates, E., Mcnew, S., Shore, C., Williamson, C., & Beeghly-Smith, M. (1981). Comprehension and production of symbols in infancy: An experimental study. *Developmental Psychology, 17*(6), 728–736.

Bronson, M. B. (1994). The usefulness of an observational measure of young children's social and mastery behaviors in early childhood classrooms. *Early Childhood Research Quarterly, 9*, 19–43. https://doi.org/10.1016/0885-2006(94)90027-2

Brown, J. R., & Dunn, J. (1996). Continuities in emotion understanding from three to six years. *Child Development, 67*(3), 789–802. https://doi.org/10.1111/j.1467-8624.1996.tb01764.x

Bullock, M., & Russell, J. A. (1984). Preschool children's interpretation of facial expressions of emotion. *International Journal of Behavioral Development, 7*, 193–214. https://doi.org/10.1016/S0163-6383(84)80255-6

Bullock, M., & Russell, J. A. (1985). Further evidence in preschoolers' interpretation of facial expressions. *International Journal of Behavioral Development, 8*(1), 15–38.

Calkins, S., & Hill, A. (2007). Caregiver influences on emerging emotion regulation. In *Handbook of emotion regulation* (pp. 229–248). New York, NY: The Guilford Press. https://doi.org/10.1002/dev.20344

Calkins, S. D. (2011). Caregiving as coregulation: Psychobiological processes and child functioning. In *Biosocial foundations of family processes* (pp. 49–59). https://doi.org/10.1007/978-1-4419-7361-0_3

Calkins, S. D., & Marcovitch, S. (2010). Emotion regulation and executive functioning in early development: Integrated mechanisms of control supporting adaptive functioning. In S. D. Calkins & M. A. Bell (Eds.), *Human brain development. Child development at the intersection of emotion and cognition* (pp. 37–57). Washington, DC: American Psychological Association. https://doi.org/10.1037/12059-003

Camras, L. A., & Allison, K. (1985). Children's understanding of emotional facial expressions and verbal labels. *Journal of Nonverbal Behavior, 9*, 84–94. https://doi.org/10.1007/BF00987140

Cole, P. M., Martin, S. E., & Dennis, T. A. (2004). Emotion regulation as a scientific construct: Methodological challenges and directions for child development research. *Child Development, 75*(2), 317–333. https://doi.org/10.1111/j.1467-8624.2004.00673.x

Committee for Children. (2015). *Self-regulation: Setting the course for success*. https://www.cfchildren.org/wp-content/uploads/programs/docs/k-5-self-regulation-skills.pdf

Committee for Children. (2016). *Second step social-emotional programming*. Seattle, WA: Author.

Cook, C. R., Low, S., Buntain-Ricklefs, J., Whitaker, K., Pullmann, M. D., & Lally, J. (2018). Evaluation of second step on early elementary students' academic outcomes: A randomized controlled trial. *School Psychology Quarterly, 33*, 561–572. https://doi.org/10.1037/spq0000233

Cooke, J. E., Stuart-Parrigon, K. L., Movahed-Abtahi, M., Koehn, A. J., & Kerns, K. A. (2016). Children's emotion understanding and mother–child attachment: A meta-analysis. *Emotion, 16*(8), 1102.

Cooper, D. H., & Farran, D. C. (1988). Behavioral risk factors in kindergarten. *Early Childhood Research Quarterly, 3*(1), 1–19. https://doi.org/10.1016/0885-2006(88)90026-9

Crandall, A., Deater-Deckard, K., & Riley, A. W. (2015). Maternal emotion and cognitive control capacities and parenting: A conceptual framework. *Developmental Review, 36*, 105–126.

Cunningham, J. N., Kliewer, W., & Garner, P. W. (2009). Emotion socialization, child emotion understanding and regulation, and adjustment in urban African American families: Differential associations across child gender. *Development and Psychopathology, 21*(1), 261–283. https://doi.org/10.1017/S0954579409000157

Curby, T. W., Brown, C. A., Bassett, H. H., & Denham, S. A. (2015). Associations between preschoolers' social–emotional competence and preliteracy skills. *Infant and Child Development, 24*(5), 549–570. https://doi.org/10.1002/icd.1899

Denham, S., & Kochanoff, A. T. (2002). Parental contributions to preschoolers' understanding of emotion. *Marriage & Family Review, 34*(3–4), 311–343.

Denham, S. A. (2006). Social-emotional competence as support for school readiness: What is it and how do we assess it? *Early Education & Development, 17*(1), 57–89. https://doi.org/10.1207/s15566935eed1701_4

Denham, S. A., Bassett, H. H., Brown, C., Way, E., & Steed, J. (2015). "I Know How You Feel": Preschoolers' emotion knowledge contributes to early school success. *Journal of Early Childhood Research, 13*(3), 252–262. https://doi.org/10.1177/1476718X13497354

Denham, S. A., Bassett, H. H., Zinsser, K., & Wyatt, T. M. (2014). How preschoolers' social–emotional learning predicts their early school success: Developing theory-promoting, competency-based assessments. *Infant and Child Development, 23*(4), 426–454. https://doi.org/10.1002/icd.1840

Denham, S. A., Zoller, D., & Couchoud, E. A. (1994). Socialization of preschoolers' emotion understanding. *Developmental Psychology, 30*(6), 928.

Dennis, T. (2006). Emotional self-regulation in preschoolers: The interplay of child approach reactivity, parenting, and control capacities. *Developmental Psychology, 42*(1), 84. https://doi.org/10.1037/0012-1649.42.1.84

Di Maggio, R., Zappulla, C., & Pace, U. (2016). The relationship between emotion knowledge, emotion regulation and adjustment in preschoolers: A mediation model. *Journal of Child and Family Studies, 25*(8), 2626–2635. https://doi.org/10.1007/s1082

Domitrovich, C. E., Cortes, R. C., & Greenberg, M. T. (2007). Improving young children's social and emotional competence: A randomized trial of the preschool "PATHS" curriculum. *The Journal of Primary Prevention, 28*(2), 67–91. https://doi.org/10.1007/s10935-007-0081-0

Duncan, G. J., Ludwig, J., & Magnuson, K. A. (2010). Child development. In P. B. Levine & D. J. Zimmerman (Eds.), *Targeting investments in children: Fighting poverty when resources are limited* (pp. 27–58). Chicago, IL: The University of Chicago Press.

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions. *Child Development, 82*(1), 405–432. https://doi.org/10.1111/j.1467-8624.2010.01564.x

Ehrlich, S. (2013). Mogreet releases best practices guide for successfully navigating text marketing rules and regulations. *The Wall Street Journal*. Retrieved from http://online.wsj.com/article/PR-CO-20130227-908303.html

Eisenberg, N., Cumberland, A., & Spinrad, T. L. (1998). Parental socialization of emotion. *Psychological Inquiry, 9*(4), 241–273. NIHMSID: NIHMS10706.

Eisenberg, N., Spinrad, T. L., & Eggum, N. D. (2010). Emotion-related self-regulation and its relation to children's maladjustment. *Annual Review of Clinical Psychology, 6*, 495–525. https://doi.org/10.1146/annurev.clinpsy.121208.131208

Eisenberg, N., & Sulik, M. J. (2012). Emotion-related self-regulation in children. *Teaching of Psychology, 39*(1), 77–83. https://doi.org/10.1177/0098628311430172

Espelage, D. L., Polanin, J. R., & Low, S. K. (2014). Teacher and staff perceptions of school environment as predictors of student aggression, victimization, and willingness to intervene in bullying situations. *School Psychology Quarterly, 29*(3), 287. https://doi.org/10.1037/spq0000072

Fishbein, D. H., Domitrovich, C., Williams, J., Gitukui, S., Guthrie, C., Shapiro, D., & Greenberg, M. (2016). Short-term intervention effects of the paths curriculum in young low-income children: Capitalizing on plasticity. *The Journal of Primary Prevention, 37*(6), 493–511. https://doi.org/10.1007/s10935-016-0452-5

Foulks, B., & Morrow, R. D. (1989). Academic survival skills for the young child at risk for school failure. *Journal of Educational Research, 82*, 158–165. https://doi.org/10.1080/00220671.1989.10885885

Fox, N. A., & Calkins, S. D. (2003). The development of self-control of emotion: Intrinsic and extrinsic influences. *Motivation and Emotion, 27*(1), 7–26. https://doi.org/10.1023/A:1023622324898

Garner, P. W., & Waajid, B. (2008). The associations of emotion knowledge and teacher–child relationships to preschool children's school-related developmental competence. *Journal of Applied Developmental Psychology, 29*(2), 89–100. https://doi.org/10.1016/j.appdev.2007.12.001

Gottman, J. M., Katz, L. F., & Hooven, C. (1996). Parental meta-emotion philosophy and the emotional life of families: Theoretical models and preliminary data. *Journal of Family Psychology, 10*(3), 243. https://doi.org/10.1037/0893-3200.10.3.243

Graziano, P. A., Reavis, R. D., Keane, S. P., & Calkins, S. D. (2007). The role of emotion regulation in children's early academic success. *Journal of School Psychology, 45*(1), 3–19. https://doi.org/10.1016/j.jsp.2006.09.002

Greenberg, M. T., Kusche, C. A., Cook, E. T., & Quamma, J. P. (1995). Promoting emotional competence in school-aged children: The effects of the PATHS curriculum. *Development and Psychopathology, 7*(1), 117–136. https://doi.org/10.1017/S0954579400006374

Hagelskamp, C., Brackett, M. A., Rivers, S. E., & Salovey, P. (2013). Improving classroom quality with the RULER approach to social and emotional learning: Proximal and distal outcomes. *American Journal of Community Psychology, 51*(3–4), 530–543. https://doi.org/10.1007/s10464-013-9570-x

Havighurst, S. S., Wilson, K. R., Harley, A. E., Prior, M. R., & Kehoe, C. (2010). Tuning in to kids: Improving emotion socialization practices in parents of preschool children-findings from a community trial. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 51*(12), 1342–1350. https://doi.org/10.1111/j.1469-7610.2010.02303.x

Heckman, J. J. (2006). Skill formation and the economics of investing in disadvantaged children. *Science, 312*(5782), 1900–1902. https://doi.org/10.1126/science.1128898

Hernández, M. M., Eisenberg, N., Valiente, C., Spinrad, T. L., VanSchyndel, S. K., Diaz, A., … Piña, A. A. (2015). Observed emotion frequency versus intensity as predictors of socioemotional maladjustment. *Emotion, 15*(6), 699–704. https://doi.org/10.1037/emo0000099

Herndon, K. J., Bailey, C. S., Shewark, E. A., Denham, S. A., & Bassett, H. H. (2013). Preschoolers' emotion expression and regulation: Relations with school adjustment. *The Journal of Genetic Psychology, 174*(6), 642–663.

Howse, R. B., Calkins, S. D., Anastopoulos, A. D., Keane, S. P., & Shelton, T. L. (2003). Regulatory contributors to children's kindergarten achievement. *Early Education and Development, 14*(1), 101–120. https://doi.org/10.1207/s15566935eed1401_7

Izard, C. E. (1991). *The psychology of emotions*. New York, NY: Plenum Press.

Izard, C. E., Fine, S., Schultz, D., Mostow, A., Ackerman, B., & Youngstrom, E. (2001). Emotion knowledge as a predictor of social behavior and academic competence in children at risk. *Psychological Science, 12*, 18–23. https://doi.org/10.1111/1467-9280.00304

Jones, S. M., & Doolittle, E. J. (2017). Social and emotional learning: Introducing the issue. *The Future of Children, 27*, 3–11. http://www.jstor.org/stable/44219018

Kayyal, M. H., Widen, S. C., & Russell, J. A. (2018). *Similar in development, different in breadth: Palestinian and American children's understanding of facial expressions*. In preparation.

Klinnert, M. D., Emde, R. N., Butterfield, P., & Campos, J. J. (1986). Social referencing: The infant's use of emotional signals from a friendly adult with mother present. *Developmental Psychology, 22*(4), 427–432. https://doi.org/10.1037/0012-1649.22.4.427

Kwon, K., Hanrahan, A. R., & Kupzyk, K. A. (2017). Emotional expressivity and emotion regulation: Relation to academic functioning among elementary school children. *School Psychology Quarterly, 32*(1), 75. https://doi.org/10.1037/spq0000166

Leerkes, E. M., Paradise, M. J., O'Brien, M., Calkins, S. D., & Lange, G. (2008). Emotion and cognition

processes in preschool children. *Merrill-Palmer Quarterly, 54*(1), 102–124. https://doi.org/10.1353/mpq.2008.0009

Lengua, L. J. (2002). The contribution of emotionality and self-regulation to the understanding of children's response to multiple risk. *Child Development, 73*(1), 144–161. https://doi.org/10.1111/1467-8624.00397

Massarani, R., Gosselin, P., Montembeault, P., Gagnon, M., & Suurland, A. (2011). *French-speaking children's freely produced labels for facial expressions*. SRCD Conference, Montreal, QC.

Mathis, E. T., & Bierman, K. L. (2015). Dimensions of parenting associated with child prekindergarten emotion regulation and attention control in low-income families. *Social Development, 24*(3), 601–620. https://doi.org/10.1111/sode.12112

McClelland, M. M., Morrison, F. J., & Holmes, D. L. (2000). Children at risk for early academic problems: The role of learning-related social skills. *Early Childhood Research Quarterly, 15*(3), 307–329. https://doi.org/10.1016/S0885-2006(00)00069-7

McElwain, N. L., Halberstadt, A. G., & Volling, B. L. (2007). Mother- and father-reported reactions to children's negative emotions: Relations to young children's emotional understanding and friendship quality. *Child Development, 78*(5), 1407–1425. https://doi.org/10.1111/j.1467-8624.2007.01074.x

Melhuish, E. C., Phan, M. B., Sylva, K., Sammons, P., Siraj-Blatchford, I., & Taggart, B. (2008). Effects of the home learning environment and preschool center experience upon literacy and numeracy development in early primary school. *Journal of Social Issues, 64*(1), 95–114. https://doi.org/10.1111/j.1540-4560.2008.00550.x

Miller, A. L., Fine, S. E., Kiely Gouley, K., Seifer, R., Dickstein, S., & Shields, A. (2006). Showing and telling about emotions: Interrelations between facets of emotional competence and associations with classroom adjustment in Head Start preschoolers. *Cognition and Emotion, 20*(8), 1170–1192. https://doi.org/10.1080/02699930500405691

Morelen, D., Shaffer, A., & Suveg, C. (2016). Maternal emotion regulation: Links to emotion parenting and child emotion regulation. *Journal of Family Issues, 37*(13), 1891–1916. https://doi.org/10.1177/0192513X14546720

Morris, A. S., Criss, M. M., Silk, J. S., & Houltberg, B. J. (2017). The impact of parenting on emotion regulation during childhood and adolescence. *Child Development Perspectives, 11*(4), 233–238. https://doi.org/10.1111/cdep.12238

Moses, L. J., Baldwin, D. A., Rosicky, J. G., & Tidball, G. (2001). Evidence for referential understanding in the emotions domain at twelve and eighteen months. *Child Development, 72*(3), 718–735. https://doi.org/10.1111/1467-8624.00311

Moy, G., Polanin, J. R., McPherson, C., & Phan, T. V. (2018). International adoption of the Second Step program: Moderating variables in treatment effects. *School Psychology International, 39*, 333–359. https://doi.org/10.1177/0143034318783339

Mullainathan, S., & Thaler, R. H. (2000). Behavioral economics (No. w7948). *National Bureau of Economic Research*. Retrieved from http://www.nber.org/papers/w7948

Nelson, N. L., Hudspeth, K., & Russell, J. A. (2013). A story superiority effect for disgust, fear, embarrassment, and pride. *British Journal of Developmental Psychology, 31*(Pt 3), 334–348. https://doi.org/10.1111/bjdp.12011

Nelson, N. L., & Russell, J. A. (2011). Preschoolers' use of dynamic facial, bodily, and vocal cues to emotion. *Journal of Experimental Child Psychology, 110*, 52–61. https://doi.org/10.1016/j.jecp.2011.03.014

NICHD Early Child Care Research Network. (2006). Child-care effect sizes for the NICHD study of early child care and youth development. *American Psychologist, 61*(2), 99–116. http://psycnet.apa.org/journals/amp/61/2/99.pdf

Parker, A. E., Mathis, E. T., & Kupersmidt, J. B. (2013). How is this child feeling? Preschool-aged children's ability to recognize emotion in faces and body poses. *Early Education and Development, 24*(2), 188–211. https://doi.org/10.1080/10409289.2012.657536

Pearl, E. S. (2009). Parent management training for reducing oppositional and aggressive behavior in preschoolers. *Aggression and Violent Behavior, 14*(5), 295–305. https://doi.org/10.1016/j.avb.2009.03.007

Perez Rivera, M. B., & Dunsmore, J. C. (2011). Mothers' acculturation and beliefs about emotions, mother–child emotion discourse, and children's emotion understanding in Latino families. *Early Education and Development, 22*(2), 324–354. https://doi.org/10.1080/10409281003702000

Posner, M. I., & Rothbart, M. K. (2000). Developing mechanisms of self-regulation. *Development and Psychopathology, 12*(3), 427–441.

Prinz, R. J., & Miller, G. E. (1994). Family-based treatment for childhood antisocial behavior: Experimental influences on dropout and engagement. *Journal of Consulting and Clinical Psychology, 62*(3), 645. https://doi.org/10.1037/0022-006X.62.3.645

Raver, C. C. (2003). Young children's emotional development and school readiness. *Social Policy Report, 16*(3), 3–19.

Raver, C. C. (2004). Placing emotional self-regulation in sociocultural and socioeconomic contexts. *Child Development, 75*(2), 346–353.

Reyes, M. R., Brackett, M. A., Rivers, S. E., Elbertson, N. A., & Salovey, P. (2012). The interaction effects of program training, dosage, and implementation quality on targeted student outcomes for the RULER approach to social and emotional learning. *School Psychology Review, 41*(1), 82–99. http://ei.yale.edu/wp-content/uploads/2013/06/pub318_Reyesetal2012_SPR.pdf

Rivers, S. E., Brackett, M. A., Reyes, M. R., Elbertson, N. A., & Salovey, P. (2013). Improving the social and emotional climate of classrooms: A clustered randomized controlled trial testing The RULER Approach. *Prevention Science, 14*(1), 77–87. https://doi.org/10.1007/s11121-012-0305-2

Russell, J. A., & Widen, S. C. (2002a). A Label Superiority Effect in children's categorization of facial expressions. *Social Development, 11*, 20–52. https://doi.org/10.1111/1467-9507.00185

Russell, J. A., & Widen, S. C. (2002b). Words versus faces in evoking preschool children's knowledge of the causes of emotions. *International Journal of Behavioral Development, 26*(2), 97–103. https://doi.org/10.1080/01650250042000582

Sanders, M. R. (1999). The Triple P - Positive Parenting Program: Towards an empirically validated multilevel parenting and family support strategy for the prevention of behaviour and emotional problems in children. *Clinical Child and Family Psychology Review, 2*(2), 71–90. https://doi.org/10.1037/a0035997

Sanders, M. R., Markie-Dadds, C., Tully, L. A., & Bor, W. (2000). The triple P-positive parenting program: A comparison of enhanced, standard, and self-directed behavioral family intervention for parents of children with early onset conduct problems. *Journal of Consulting and Clinical Psychology, 68*(4), 624–640. https://doi.org/10.1037/0022-006X.68.4.624

Shields, A., Dickstein, S., Seifer, R., Giusti, L., Dodge Magee, K., & Spritz, B. (2001). Emotional competence and early school adjustment: A study of preschoolers at risk. *Early Education and Development, 12*(1), 73–96. https://doi.org/10.1207/s15566935eed1201_5

Smith, M., & Walden, T. (1999). Understanding feelings and coping with emotional situations: A comparison of maltreated and nonmaltreated preschoolers. *Social Development, 8*, 93–116. https://doi.org/10.1111/1467-9507.00082

Stack, D. M., Serbin, L. A., Enns, L. N., Ruttle, P. L., & Barrieau, L. (2010). Parental effects on children's emotional development over time and across generations. *Infants & Young Children, 23*(1), 52–69. https://doi.org/10.1097/IYC.0b013e3181c97606

Stevenson, H. W., Chen, C., & Uttal, D. H. (1990). Beliefs and achievement: A study of black, white, and hispanic children. *Child Development, 61*(2), 508–523. https://doi.org/10.1111/j.1467-8624.1990.tb02796.x

Thaler, R. H., & Sunstein, C. R. (2008). *Nudge: Improving decisions about health, wealth, and happiness*. New Haven, CT: Yale University Press.

Thompson, R. A., Lewis, M. D., & Calkins, S. D. (2008). Reassessing emotion regulation. *Child Development Perspectives, 2*(3), 124–131. https://doi.org/10.1111/j.1750-8606.2008.00054.x

Trentacosta, C. J., & Fine, S. E. (2010). Emotion knowledge, social competence, and behavior problems in childhood and adolescence: A meta-analytic review. *Social Development, 19*(1), 1–29. https://doi.org/10.1111/j.1467-9507.2009.00543.x

Trentacosta, C. J., & Izard, C. E. (2007). Kindergarten children's emotion competence as a predictor of their academic competence in first grade. *Emotion, 7*(1), 77–88. https://doi.org/10.1037/1528-3542.7.1.77

Trentacosta, C. J., & Shaw, D. S. (2009). Emotional self-regulation, peer rejection, and antisocial behavior: Developmental associations from early childhood to early adolescence. *Journal of Applied Developmental Psychology, 30*(3), 356–365. https://doi.org/10.1016/j.appdev.2008.12.016

Ursache, A., Blair, C., & Raver, C. C. (2012). The promotion of self-regulation as a means of enhancing school readiness and early achievement in children at risk for school failure. *Child Development Perspectives, 6*(2), 122–128. https://doi.org/10.1111/j.1750-8606.2011.00209.x

Walden, T. A., & Kim, G. (2005). Infants' social looking toward mothers and strangers. *International Journal of Behavioral Development, 29*(5), 356–360. https://doi.org/10.1080/01650250500166824

Webster-Stratton, C., Jamila Reid, M., & Stoolmiller, M. (2008). Preventing conduct problems and improving school readiness: Evaluation of the Incredible Years Teacher and Child Training Programs in high-risk schools. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 49*(5), 471–488. https://doi.org/10.1111/j.1469-7610.2007.01861.x

Widen, S. C. (2013). Children's interpretation of facial expressions: The long path from valence-based to specific discrete categories. *Emotion Review, 5*(1), 72–77. https://doi.org/10.1177/1754073912451492

Widen, S. C. (2016). The development of children's concepts of emotion. In L. F. Barrett, M. Lewis, & J. M. Haviland-Joanes (Eds.), *Handbook of emotions* (4th ed., pp. 307–318). New York, NY: Guilford.

Widen, S. C. (2017). The development of emotion recognition. In J.-M. Fernandez-Dols & J. A. Russell (Eds.), *The science of facial expressions* (pp. 297–312). New York, NY: Oxford University Press.

Widen, S. C., Bardack, S. R., Jang, H., & Loeb, S. (2017). *TIPS by TEXT: A text messaging intervention to help parents support preschoolers' social-emotional skills*. In preparation.

Widen, S. C., & Russell, J. A. (2003). A closer look at preschoolers' freely produced labels for facial expressions. *Developmental Psychology, 39*(1), 114–128. https://doi.org/10.1037/0012-1649.39.1.114

Widen, S. C., & Russell, J. A. (2004). The relative power of an emotion's facial expression, label, and behavioral consequence to evoke preschoolers' knowledge of its cause. *Cognitive Development, 19*(1), 111–125. https://doi.org/10.1016/j.cogdev.2003.11.004

Widen, S. C., & Russell, J. A. (2008). Children acquire emotion categories gradually. *Cognitive Development, 23*(2), 291–312. https://doi.org/10.1016/j.cogdev.2008.01.002

Widen, S. C., & Russell, J. A. (2010a). Children's scripts for social emotions: Causes and consequences are more central than are facial expressions. *British Journal of Developmental Psychology, 28*(3), 565–581. https://doi.org/10.1348/026151009X457550d

Widen, S. C., & Russell, J. A. (2010b). Differentiation in preschoolers' categories for emotion. *Emotion, 10*, 651–661. https://doi.org/10.1037/a0019005

York, B. N., Loeb, S., & Doss, C. (2017). *One step at a time: The effects of an early literacy text messaging program for parents of preschoolers*. Submitted for Publication.

Zelazo, P. D., & Cunningham, W. A. (2007). Executive function: Mechanisms underlying emotion regulation. In J. J. Gross (Ed.), *Handbook of emotion regulation* (2nd ed., pp. 135–158). New York, NY: Guilford.

Emotional Competence During Childhood and Adolescence

Susanne A. Denham

Abstract

Through childhood and adolescence, youngsters are learning how to express and regulate their myriad feelings and understand the emotions of self and others. They are acquiring *emotional competence.* Specifically, emotional competence is the ability to purposefully and fully experience and express a variety of emotions, regulate emotional expressiveness and experience when necessary, and understand the emotions of self and others. These skills, as they develop through childhood and adolescence, support successful resolution of developmental tasks centering upon social and academic success. Based on the nature and importance of children's and youth's emotional competence, this chapter's structure is as follows. First, each component of emotional competence is discussed in turn; for each, its nature and development during each age period are discussed. Second, within each component and at each age level, evidence of relations with social competence (or lack of social competence as evidenced in behavior problems) and school success (where available) are detailed. Third, components of emotional competence also may work synergistically together to promote positive outcomes; this possibility is discussed next. Fourth, others' promotion of these competencies will be considered. Parents' and friends' contributions to the development of emotional competence are discussed, along with the small literature on teachers' socialization of emotional competence. Finally, conclusions and calls for future work sum up findings and issues put forward in the chapter.

Through childhood and adolescence, youngsters are learning how to express and regulate their myriad feelings and understand the emotions of self and others. They are acquiring *emotional competence.* Specifically, emotional competence is the ability to purposefully and fully experience and express a variety of emotions, regulate emotional expressiveness and experience when necessary, and understand the emotions of self and others (Denham, 1998; Saarni, 1999; see also Booker & Dunsmore, 2017; Camras & Halberstadt, 2017; Halberstadt, Denham, & Dunsmore, 2001 for the closely allied *affective social competence* model).

These emotional competence skills develop dramatically from early childhood through adolescence. During the preschool years, such skills help preschoolers to succeed at important developmental tasks of the period – maintaining positive emotional and behavioral engagement in the physical

S. A. Denham (✉)
George Mason University,
Department of Psychology, Fairfax, VA, USA
e-mail: sdenham@gmu.edu

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_20

and social environment; making and maintaining relationships with other children and adults; and dealing with emotions in demanding group contexts where they are required to sit still, attend, follow directions, and navigate playing groups.

Emotions are ubiquitous in early childhood classrooms. To learn alongside and in collaboration with teachers and peers, young children must utilize their emotional competencies to facilitate learning (Denham, Brown, & Domitrovich, 2010). Such competencies are identified as among the most important abilities supporting early school success and the growth of even later academic competence (Denham, Bassett, Mincic, et al., 2012; Romano, Babchishin, Pagani, & Kohen, 2010). Thus, children, who understand and regulate emotions and are more emotionally positive when they enter school, are more likely to develop positive and supportive relationships with peers and teachers, participate more, and achieve at higher levels throughout their early years in school (Garner & Waajid, 2008; Graziano et al., 2007; Izard et al., 2001; Leerkes et al., 2008). Conversely, children who enter school with fewer emotional competence skills are more often rejected by peers, develop less supportive relationships with teachers, participate in and enjoy school less, achieve at lower levels, and are at risk for later behavior problems and school difficulties (Denham, Bassett, Mincic, et al., 2012, Denham, Bassett, Thayer, et al., 2012; Herndon, Bailey, Shewark, Denham, & Bassett, 2013). In short, emotional competence greases the cogs of a successful early school experience, with potentially long-lasting effects. One major longitudinal study has shown that prosocial behavior in kindergarten (including understanding and regulating emotion) was associated with young adult success in education, employment, mental health, and avoidance of crime and substance use, independent of child, family, and contextual factors (Jones, Greenberg, & Crowley, 2015).

During gradeschool and adolescence, emotional competence skills remain important while increasing in complexity; they continue to support successful negotiations of developmental tasks (Denham, Wyatt, Bassett, Echeverria, & Knox, 2009). For gradeschoolers, the key developmental tasks focus on interactions with peers – forming dyadic friendships, being liked by peers, and remitting from earlier, more developmentally typical, aggression. Successfully navigating these experiences is crucial to social success and subjective well-being in middle childhood and continued adjustment in school. By adolescence, developmental tasks include continuing, more intimate, relationships with peers and beginning romantic relationships; adolescents also are balancing relationships with parents and peers, as well as evidencing an increasing need for independence. Emotional competence supports successful resolution of these developmental tasks throughout older children's and adolescents' development and continues its association with school success (Miller-Slough & Dunsmore, 2016; Oberle, Schonert-Reichl, Hertzman, & Zumbo, 2014).

Educators and parents are becoming ever more aware of the importance of emotional competence and related issues (Bridgeland, Bruce, & Hariharan, 2013; Piotrkowski, Botsko, & Matthews, 2000; Wesley & Buysse, 2003). Teachers view children's "readiness to learn" and "teachability" as marked by positive emotional expressiveness and ability to regulate emotions and behaviors (Rimm-Kaufman, Pianta, & Cox, 2000), as well as by emotional competence-related social strengths (Lin, Lawrence, & Gorrell, 2003). Further, children's emotional competence is being recognized as important within the policy area. A content analysis shows that most US states have early childhood standards that include social and emotional competencies, albeit less systematically and with fewer indicators than cognitive skills (Dusenbury et al., 2015). Far fewer (about 1/3 of states) have standards through high school (CASEL, 2018b). Such integration into US state standards has increased examination of these competencies at the classroom level.

Furthermore, the USA has seen recent national legislation authorizing allocation of funds for technical assistance, training, and programming related to emotional competence, including the Every Student Succeeds Act; other legislation with ramifications for social-emotional learning is being introduced (CASEL, 2018a). Educators are being called to help children acquire these competencies by modeling genuine, appropriate

emotions and responses to emotions, discussing emotions with children, and using positive emotions to support learning.

In summary, based on these assertions on the nature and importance of children's and youth's emotional competence, this chapter's structure is as follows. First, each component of emotional competence is discussed in turn; for each, its nature and development during each age period are discussed. Then, within each component at each age level, evidence of relations with social competence (or lack of social competence as evidenced in behavior problems) and school success (where available) are detailed. The components of emotional competence also may work synergistically together to promote positive outcomes; this possibility is discussed next.

Third, others' promotion of these competencies will be considered. Parents' and friends' contributions to the development of emotional competence are discussed, along with the small literature on teachers' socialization of emotional competence. Finally, conclusions and calls for future work sum up what has been laid forth here.

Of note, culture, context, gender, and individual children's temperaments are obvious potential boundary conditions – does emotional competence "work" similarly for all children and groups, in all settings, and do notions of promoting it come as "one size fits all"? The answer is undoubtedly "no." These issues are critical, but because of space limitations their treatment here is modest; for deeper understanding, the reader is referred to Cole and Tan (2007); Denham, Warren, et al. (2011); Friedlmeier, Çorapçı, and Benga (2015); and Trommsdorff and Cole (2011) for cultural matters, Root and Denham (2010) for gender issues, and Calkins and Mackler (2011) for temperament.

Components of Emotional Competence: Emotional Expressiveness

Emotional expressiveness, including the experience of one's own emotions and sending of emotional messages to others, is central to emotional competence. Emotions must be expressed in accordance with one's goals and the social context. Children need to coordinate the goals of self and of others, experiencing and expressing emotions in a way that is advantageous to moment-to-moment interaction, and to relationships over time (Halberstadt et al., 2001).

What, more specifically, does the expression of emotions "do for" a child and his/her social group? Most importantly, emotions provide social information signaling whether the child or other people need to modify or continue their goal-directed behavior (Walle & Campos, 2012). An example is fear – if a child experiences fear when another child frequently hits/bullies him (whether in preschool or later), she/he may avoid the other child across shared settings and even ask mother or teacher for help. The experience of fear gives the child important information that affects subsequent behavior. Peers also benefit from witnessing other children's expressions of emotion; for example, witnesses to a girl's anger likely know from experience whether their most profitable response would be to fight back or to retreat.

Preschoolers learn to use emotional communication to express nonverbal messages about a social situation or relationship – for example, giving a hug to express the emotion of tenderness. They are expressing all the "basic" emotions (e.g., happiness, sadness, anger, and fear) and develop empathic involvement in others' emotions, for example, kissing a baby sister when she falls down and bangs her knee. Further, they display complex social and self-conscious emotions, such as guilt, pride, shame, and contempt, in appropriate contexts. Finally, preschoolers begin to realize that a person may feel a certain way "on the inside" but show a different visible demeanor. They are learning that they can control overt expression of socially disapproved feelings, in favor of expressing more socially appropriate emotions – for example, one might feel afraid of an adult visitor, but show no emotion or even a slight smile (Denham, 1998).

With time and experience, older children learn that their goals are not always met by showing intense feelings; subtlety becomes the norm. Overt negative expressiveness and its intensity decline from preschool to the end of gradeschool (Murphy, Eisenberg, Fabes, Shepard, & Guthrie,

1999). "Letting it all hang out" is uniformly selected by elementary-aged children as the worst reaction to negative emotional experiences with peers (Saarni, 1997). Thus, these older children often express emotions less directly and vividly than before. Emotional expression depends with whom, and in what situation, they are interacting; display rules become important. For example, they regulate anger due to expected negative consequences (Zeman & Shipman, 1996). Although these "fronts" make children's expressions less genuine, they also have positive aspects, such as saving face and surviving in a potentially hostile peer environment. Along with this "cool rule" that mandates more muted emotions within many settings (especially anger, gloating, envy; von Salisch, 2000), older children's emotional messages can be more complex, with use of more blended signals, and better-differentiated expressions of social emotions.

Adolescents continue the trend of experiencing more positive than negative emotions (Malinen, Rönkä, Tolvanen, Sevón, & Jokinen, 2015); all may not be "sturm und drang." They do shift toward expressing and experiencing more negative emotionality than previously (Frost, Hoyt, Chung, & Adams, 2015; Larson, Moneta, Richards, & Wilson, 2002); much of this negative emotion may be expressed with friends. They also report more intense emotions than their parents, with frequent ups and downs (Larson & Richards, 1994). Finally, moral and achievement-related emotions uptick during adolescence (Malti & Ongley, 2014; Pekrun, 2017).

Outcomes of Emotional Expressiveness

Preschoolers' Social Competence[1]

Enduring patterns of preschoolers' emotional expressiveness become potent intrapersonal supports for, or roadblocks to, interacting with age-mates. Thus, young children's emotional styles contribute to their overall success in interacting with one's peers: for example, an often sad or angry child is less able to see, let alone respond to, others' emotional needs. Given this inability, her interactions may be less than effective; her emotions are hampering her social competence. It is no wonder when her peers flatly assert, "She hits. She bites. She kicked me this morning. I *don't like* her." Conversely, a generally happier preschooler may better afford to respond positively, socially, and effectively.

More specifically, *positive* emotion is important in the initiation and regulation of social exchanges; sharing positive affect may further facilitate the formation of friendships and render one more likable. A child who displays more positive emotions manifested by smiling and laughing becomes an inviting beacon signaling "Come join me" to adults and classmates alike. *Negative* affect, especially anger, can be quite problematic in social interaction. Preschoolers who can balance their positive and negative emotions are seen by teachers and peers as more likeable, friendly, assertive, less aggressive, and less sad. They also respond more prosocially to peers' emotions (e.g., Denham, McKinley, Couchoud, & Holt, 1990).

These outcomes of preschoolers' emotional expressiveness patterns have more recently garnered much empirical support, corroborating and extending earlier findings. Positive emotional expressiveness during dyadic play was related to several indices of social competence, including peer acceptance, initiating peer interaction, receiving peers' attention, and teachers' ratings (Shin et al., 2011; see also Garner & Waajid, 2008). Hernández and colleagues (Hernández, Eisenberg, Valiente, Diaz, et al., 2017; Hernández, Eisenberg, Valiente, Spinrad, et al., 2017) showed that preschoolers' positive emotion frequency was related to peer acceptance and *lack* of peer rejection, and that such positivity was especially predictive of peer acceptance for children who exhibited lower effortful control. Lindsey (2017) extended these findings even further, demonstrating that preschoolers who were observed sharing more *mutual* positive emotion with peers were better liked 1 year later.

[1] In the following discussions, as often as possible research reported on partials pertinent covariates. Of course, this is not always the case, but is more and more a practice being followed appropriately. This point will not be remarked upon in the text.

Adding further longitudinal findings, Morgan, Izard, and Hyde (2014) found that observed happiness and engagement in a happy task (blowing bubbles) predicted children's positive social behavior 6 months later.

Regarding preschoolers' social and self-evaluative emotions, empathetic concern, achievement pride and lack of shame at failure were related to amend-making; moral pride, achievement pride, and resilience to shame were related to spontaneous help (Ross, 2017). These positive functions social and self-evaluative emotions are important and require further study. However, context is always important. Five-year-olds' empathic concern to mothers' simulated positive and negative emotions were related to internalizing problems for those exposed to chronic maternal depression. In contrast, children's empathy to mothers' positive emotions was negatively related to internalizing for children nondepressed mothers. Empathy emanating from heightened sensitivity to the affective environment can be a protective regulatory strategy for children at risk, but at a cost – a "double-edged sword" (Thompson & Calkins, 1996).

Conversely, negative emotion (particularly anger) indexes concurrent social difficulty. Hernández, Eisenberg, Valiente, Diaz, et al. (2017) noted that kindergarten girls' negative emotion was related to lessened peer acceptance. Kindergartners' anger frequency was related to lower levels of peer acceptance and conflict with teachers (Hernández, Eisenberg, Valiente, Spinrad, et al., 2017), and anger intensity was related to more conflict and less closeness with teachers (see also Diaz et al., 2017). Anger's contextual appropriateness may be especially important; context inappropriate anger was related to preschoolers' self-rejection and loneliness, and negative peer and teacher social competence nominations (Locke, Davidson, Kalin, & Goldsmith, 2009).

Deleterious outcomes of anger also can extend across time. For example, toddlers' observed and reported anger indirectly negatively predicted early gradeschool social competence (Taylor, Eisenberg, VanSchyndel, Eggum-Wilkens, & Spinrad, 2014). Slightly older children's anger was negatively related to their later social competence (assertion, cooperation, and self-control; Chang, Shelleby, Cheong, & Shaw, 2012). Negative reactivity at age 6 predicted lower levels of prosocial behavior at age 7 (Laible et al., 2017). In short, enduring negative expressiveness can set about a cascade of equally negative social outcomes.

Behavior problems (e.g., aggression, hyperactivity, social withdrawal, anxiety) are also often related to emotional competence difficulties, such as a preponderance of negative expressiveness. For example, children's dysregulated anger during a disappointing gift task was both concurrently and predictively associated with teachers' ratings of externalizing behavior problems (Morris, Silk, Steinberg, Terranova, & Kithakye, 2010). Further, kindergartners' negative emotional expressiveness (anger, sadness, fear) was related to their behavior problems, particularly for those with lower effortful control, suggesting that dealing with intense, difficult emotions may be especially problematic for children with less developed self-regulation (Diaz et al., 2017). Corroborative results exist (Moran, Lengua, & Zalewski, 2013; Morris, Keane, Calkins, Shanahan, & O'Brien, 2014). Children observed as more fearful or frustration-prone, and lower in executive control, were rated by mothers as showing more externalizing problems, whereas those rated by mothers as more fearful and assessed as higher in delay ability were rated as showing fewer externalizing problems (Moran et al., 2013). Continuing broad consideration of self-regulation problems and negative expressiveness, young children with attention deficit hyperactivity disorder (ADHD) symptoms showed more annoyance than those without such symptoms during a frustration task, even though both ADHD and non-ADHD children were indeed irritated by the task (Lugo-Candelas, Flegenheimer, McDermott, & Harvey, 2017).

In short, accumulating and expanding research notes the importance of both positive and negative emotional expressiveness for young children's social competence with peers and teachers alike, as well as their behavior problems. The intimate connection between emotional compe-

tence and self-regulation and the relation among aspects of emotional competence (e.g., Giesbrecht, Miller, & Müller, 2010) are themes that will be revisited.

Preschoolers' School Success

Attention is also being given to the contribution of emotional expressiveness styles to school success. Positive emotion may, for example, support and direct attention, facilitate information processing, and enhance both motivation and resilience (Pekrun & Linnenbrink-Garcia, 2012). In alignment with this assertion, emotionally positive engagement with an examiner was related to literacy outcomes (Denham, Bassett, Sirotkin, & Zinsser, 2013). Positive emotional experience and expressiveness with adults signal enjoyment and motivation to learn to self and others. Elaborating on contexts where young children display positive emotions, Hernández et al. (2016) examined patterns of kindergartners' emotional expressiveness during classroom free play, lunch and recess; positive emotions were positively related to concurrent academic success (i.e., literacy skills, achievement, and/or school engagement, with some relations context-specific), either directly or via positive relationships with teachers and peers. Perhaps surprisingly, even positive affect rated by mothers at infants' age of 4 months and observed at 12 months was related to 4-year-olds' school readiness (e.g., color and letter knowledge; Gartstein, Putnam, & Kliewer, 2016).

Conversely, Herndon et al. (2013) found that preschoolers' *negative* emotionality (especially when dysregulated) was associated with lower levels of teachers' later reports on positive engagement and independent motivation in learning, especially for boys. Similarly, Denham, Bassett, Thayer, et al. (2012) also showed that patterns of preschoolers' negative expressiveness (predominantly anger) were related to lack of both current and later school adjustment, as well as kindergarten academic success (see also Diaz et al., 2017; Hernández et al., 2016). Examining more specific negative emotions, Valiente, Lemery-Chalfant, and Swanson (2010) found that adults' ratings of preschoolers' sadness, anger, and shyness were negatively related to academic achievement.

At the same time, attention must be given to notions of culture, because this valuing of positive expressiveness over relative excess of negative expressiveness may be distinctly Western, in individualistic cultures where the focus is on the child's autonomous success in the environment. In contrast, non-Western, relational cultures may value an altogether less expressive presentation of self, because of the goal of group harmony. In support of this possibility, Louie, Wang, Fung, and Lau (2015) found that for Korean and Asian American preschoolers, their sadness and happiness expressivity were both associated with negative peer or teacher outcomes. More value was perhaps placed on a calm demeanor for these children.

Gradeschoolers' and Adolescents' Social Competence, Behavior Problems, and School Success

Much less research has investigated these linkages in middle childhood. However, more studies are emerging. When children aged 54 months had emotional profiles characterized by higher negativity, especially for anger, they were rated as less socially competent both concurrently and predictively to gradeschool (Laible, Carlo, Murphy, Augustine, & Roesch, 2014). In another study, adolescents reporting higher state and trait anger showed more aggression and less prosocial behavior 2 years later (Mesurado, Vidal, & Mestre, 2018).

Some extant research for this age range focuses on behavior problems as an outcome, correlate, or moderator. For example, 8- to 14-year-olds' positive emotions' (i.e., happiness, excitement) intensity and frequency were negatively related to teacher and peer views of their externalizing behavior problems (i.e., aggression, hyperactivity, and delinquency; Kim, Walden, Harris, Karrass, & Catron, 2007). Conversely, elementary school children whose parents rated them higher on ADHD *and* anger were rated as more aggressive by peers, and those whose parents rated them higher on ADHD but lower on happiness/exuberance were more likely to be dis-

liked by peers (Thorell, Sjöwall, Diamatopoulou, Rydell, & Bohlin, 2017).

Further, in their recent meta-analysis Mathews, Koehn, Abtahi, and Kerns (2016) also confirmed that children and adolescents experiencing anxiety, assessed in several ways, were "less effective at physically and verbally expressing emotions" (p. 169; see also Carthy, Horesh, Apter, Edge, & Gross, 2010; Hurrell, Hudson, & Schniering, 2015). Perhaps fearfulness renders it more difficult for these children to confidently express their other emotions.

Finally, recent work by Ansary, McMahon, and Luthar (2017) has continued to add breadth and depth to understanding of emotional expressiveness in adolescents, especially those with behavior problems. In their study, peer reports of emotion indicated that youth in an internalizing problem cluster were more shy/anxious and sad than others; those in the externalizing cluster were more irritable. This clear connection between behavior problems and emotional expressiveness extended to school outcomes: sixth graders in both the internalizing and externalizing clusters were less adjusted to the classroom (frustration tolerance, task orientation) and those in the externalizing cluster got lower grades.

Summary of Outcomes of Emotional Expressiveness In short, preschoolers' expression of emotions, especially a positive emotional style, appears central to young children's concurrent and later positive outcomes in both social and academic realms. Overall, the smaller body of research on older children's and adolescents' expressiveness echoes that finding and situates expressiveness within the context of behavior problems. Educators could work to promote students' positive emotion and ability to deal with negative emotions and their source.

Components of Emotional Competence: Emotion Regulation

Becoming more independent, especially beginning to attend preschool or childcare, is an important transition that taxes young children's emotion regulatory skills. Initiating, maintaining, and negotiating play, earning acceptance, resolving conflicts, taking turns, and sitting still, all require preschoolers to "keep the lid on." Yet preschoolers' newly important peers are not very able to aid others' emotion regulation, and the social cost of emotional dysregulation is high with teachers, parents, and peers. Some organized emotional gatekeeper must be cultivated.

Thus, when intensity, duration, or other parameters of the experience and expression of emotion are "too much" or "too little" to meet goals and expectations of the child and/or social partners, emotion regulation is needed (Thompson, 1994). Negative *or* positive emotions can need regulating, when they threaten to overwhelm or need to be amplified. Children learn to retain or enhance those emotions that are relevant and helpful, to attenuate those that are relevant but not helpful, and to dampen those that are irrelevant; these skills help them to experience more well-being and maintain satisfying relationships with others. For example, a little boy may know that showing too much anger will hurt one friend's feelings but showing too *little* angry bravado with another (who is bullying) could make him more of a target.

Early in the preschool period, much of this self-management is biobehavioral (e.g., thumb-sucking) and often supported by adults; for example, even though very upset when a younger playmate grabs all the toys, one can use the caregiver's assistance instead of immediately resorting to aggression. As children progress through this period, they become able to regulate their emotions more independently, because of increased cognitive ability and voluntary control of both their attention and their emotionality.

More specifically, regulation of emotion becomes more *volitional*, implying that young children become able to purposefully modify spontaneous expressions of experienced emotions, via amplification, minimization, neutralization, masking, or simulation of expressions, resulting in a disjunction between expression and experience of emotion (Kromm, Färber, & Holodynski, 2015); volitional emotion regulation is seen to increase from preschool to gradeschool. Such volitional, or reflective, emotion regulation becomes possible as children acquire the cogni-

tive self-regulation skills needed to direct attention to the problem, create plans, control prepotent responses that would foil the plans, and carry them out (Holodynski, Seeger, Kortas-Hartmann, & Wörmann, 2013; see also Hudson & Jacques, 2014, as well as Orta, Çorapçı, Yagmurlu, & Aksan, 2013, who corroborate the role of self-regulation in late preschoolers' emerging emotion regulation and dysregulation). Moreover, increasing language skills aid in distancing from emotions, and "mental time travel" (Holodynski et al., 2013, p. 31) allows children to conceive of the very plans that will lead to goal attainment. Finally, children learn a menu of strategies related to the various goals they may plan to attain. These skills allow for transitioning from *co-regulation* with adults to *self-regulation* of emotions.

Thus, strategies used in emotion regulation are very important. Perhaps, along with the skills of reflective emotion regulation, converging social and cognitive pressures concomitant with learning and interacting in groups motivate preschoolers gradually to use specific emotion regulation strategies – problem-solving, support-seeking, distancing, internalizing, externalizing, distraction, reframing or redefining the problem, cognitive "blunting," and denial. Although preschoolers are capable of the more cognitive emotion regulation strategies (e.g., reframing and redefining, "thinking about something else"), they more often use simpler means, particularly venting, distraction, and support-seeking (López-Pérez, Gummerum, Wilson, & Dellaria, 2017). As well, in agreement with Holodynski et al. (2013), more advanced language may support emotion regulation efforts, enabling children to successfully ask for help and use creative means to redirect attention; young children with better language skills as toddlers expressed less intense anger as 4-year-olds (Roben, Cole, & Armstrong, 2013).

Finally, some investigators are beginning to successfully address Thompson's view of emotion regulation as a *process* as well as an *outcome,* and to examine developmental changes in the temporal dynamics of emotion regulatory experiences (Cole, 2014). Cole, Bendezú, Ram, and Chow (2017) have shown that when 3-year-olds were prevented from opening a desirable gift (and, of course, had a high prepotent response of wanting the gift and frustration at being blocked), they engaged in successful, mature executive process-driven emotion regulatory strategy usage, such as focused distraction. As the 8-min task progressed, however, their strategy effectiveness diminished, especially for children with externalizing behavior problems.

In the same vein, but examining developmental change, Morales et al. (2018) found that 5-year-olds showed more efficient fear-related regulation than at 2 years old. Five-year-olds more quickly deployed regulatory strategies. However, children at both ages used strategies throughout visits from a potentially fear-inducing clown or "lion." Thus, strategies (whether one would consider them "mature" or not; this study collapsed across this dimension) are used in similar quantity and potency at both ages. Examination of such temporal dynamics has the potential to add immeasurably to our understanding of emotion regulation and its intimate pairing with emotional expression and experience; though such research is complex to undertake, investigators should take up the challenge to further this exploration.

With increasing age after preschool, socialization messages of others, as well as even more sophisticated cognitive abilities (e.g., abilities to appraise the controllability of emotional experience, intentionally shift thoughts, self-comfort through subvocal reassurance, or flexibly examine different aspects of situations), motivate and allow for more advanced emotion regulation in accordance with the "cool rule" (von Salisch, 2000). Thus, gradeschoolers are increasingly able to independently use more cognitively focused and situationally targeted strategies to regulate emotion, such as situation selection, modification, and reappraisal. At the same time, they endorse distancing from uncontrollable stressors and rely less on support-seeking (López-Pérez et al., 2017; Sala, Pons, & Molina, 2014; von Salisch, 2008).

Further, gradeschoolers are coming to understand that some strategies work for specific emotions. Waters and Thompson (2014) found that, although choices of strategies were related across

anger- and sadness-eliciting situations, gradeschoolers most highly endorsed problem-solving as effective for anger and seeking adult support and venting as effective for sadness. Nine-year-olds rated ineffective strategies (i.e., venting and doing nothing) less highly than 6-year-olds. Wan and Savina (2016) also found that both Chinese and American gradeschoolers considered it profitable to avoid an angry situation or talk to someone, but to practice deep breathing for sadness. Thus, older children are aware of the strategies at their command and consider their likelihood of success in different contexts.

During adolescence, emotion regulation can become more complicated. Although building upon the foundation of emotion regulation set in earlier years, the challenges of changing bodies, minds and social relationships, can render it more difficult to deal with feelings (Cole, 2014). The social context is important for adolescents' emotion regulation; the role of parents and friends will be examined within the consideration of socialization of emotion.

Outcomes of Emotion Regulation and Dysregulation

Preschoolers' Social Competence and Behavior Problems

Maternal and teacher reports of effective emotion regulatory coping are associated with success with peers and overall social effectiveness during the preschool years (Denham, Blair, Schmidt, & DeMulder, 2002; Di Maggio, Zappulla, & Pace, 2016; Orta et al., 2013; Ren, Wyver, Rattanasone, & Demuth, 2016; Spritz, Sandberg, Maher, & Zajdel, 2010; Son & Chang, 2018). In fact, there are cascading and reciprocal relations between emotion regulation and aspects of social competence from age 5 to 10; age 5 emotion regulation five predicted age 7 social competence, which then predicted age 10 peer acceptance, friendship quality, and emotion regulation (Blair et al., 2015).

Preschoolers' emotion regulation also has been measured observationally, sometimes across longitudinal periods. Five-year-olds' active, not passive or disruptive, emotion regulation when faced with a disappointing gift predicted socially competent peer play at age 7 (Penela, Walker, Degnan, Fox, & Henderson, 2015); similar findings have been obtained, with positive reactions to a disappointing gift predicting older preschoolers' peer status (Nakamichi, 2017).

Examining preschoolers' behavioral and physiological emotion regulation together also has been profitable. For example, negative emotion and disengagement in a distress task predicted negative social behavior 6 months later, and marginally negatively predicted positive social behavior (Morgan et al., 2014). Greater physiological *reactivity* during the distress task (assessed by heart reactivity) was related to more negative social behavior, but greater physiological *recovery from* the distress task was related to more positive social behavior. In contrast, greater physiological recovery from the exuberance task predicted less positive social behavior. The authors suggested that effective regulation at this age may consist of maintaining positive emotions and decreasing negative arousal; the valence of the experience matters.

Despite the growth demonstrated in these studies, emotion regulatory failure still occurs throughout the preschool period; such emotion dysregulation or lack of positive emotion regulatory strategy usage is often associated with young children's concurrent or later difficulties with aggression, other externalizing behavior and internalizing behavior, and compromised social competence (Chang et al., 2012; Crespo, Trentacosta, Aikins, & Wargo-Aikins, 2017; Di Maggio et al., 2016; Miller, Gouley, Seifer, Dickstein, & Shields, 2004; Ren et al., 2016). Moreover, examining longitudinal change, Cohen and Mendez (2009) found that for low SES African American preschoolers, emotional lability in the fall of an academic year was associated with consistently maladaptive and declining social competence later in the year.

More specifically, use of maladaptive emotion regulatory strategies can be associated with behavioral difficulties. For example, preschoolers rated as anxious by their parents were reported as using more venting strategies both generally

and in emotionally difficult situations, and young children with ADHD symptoms evidenced difficulties using regulation strategies during a frustration task (Lugo-Candelas et al., 2017; Yeo, Frydenberg, Northam, & Deans, 2014). Clearly emotional dysregulation, variously considered, already constitutes a risk factor.

Preschoolers' School Success

As already noted, demands of the new preschool environment can also be emotionally challenging and call for emotion regulation. Thus, emotion regulation is also related to classroom adjustment, academic success, and other indices of school readiness (Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008; Brophy-Herb, Zajicek-Farber, Bocknek, McKelvey, & Stansbury, 2013). Children less able to deal with negative emotions may not have personal resources to focus on learning, whereas those who can maintain a positive emotional tone might be able to remain positively engaged with classroom tasks (Denham et al., 2013; Graziano, Reavis, Keane, & Calkins, 2007; Herndon et al., 2013; Miller, Seifer, Stroud, Sheinkopf, & Dickstein, 2006; Shields et al., 2001; Trentacosta & Izard, 2007).

Gradeschoolers' and Adolescents' Social Competence, Behavior Problems, and School Success

The ability to regulate emotions in an age-appropriate manner continues to relate concurrently or predictively with older children's social competence. For example, first grade teacher-rated emotion regulation predicted second grade peer preference (Kam et al., 2011). As in early childhood, emotion regulation also is related to or predictive of behavior problems; early gradeschoolers' emotion regulation and lack of lability/negativity was related to parental report of fewer behavior problems (Duncombe, Havighurst, Holland, & Frankling, 2013). Further, the inability to manage intense emotions in third grade predicted symptoms of anxiety in fifth grade (Brumariu & Kerns, 2013). Complementarily, dysregulated anger (high anger reactivity paired with low attentional control) during preschool predicted 10-year-olds' externalizing problems, controlling for preschool externalizing (Morris et al., 2014).

Regarding adolescents, Laible, Carlo, Panfile, Eye, and Parker (2010) employed a person-centered approach to isolate groups differing on self-reports of negative emotional emotionality (i.e., their experience of emotion) and emotion regulation. Teens characterized by high negativity and low emotion regulation showed elevations of negative behaviors (e.g., aggression, personal distress at others' plights, and negative expressiveness). Youth low on negative emotionality but high in regulation reported the least negative behavior; those moderate on both dimensions, interestingly, reported the most positive social behaviors.

Contextualizing adolescents' emotion regulation, one study focused on sixth to 11th graders' reactivity to conflict in the family (Cook, Buehler, & Blair, 2013). Early adolescents' emotional reactivity to earlier interparental conflict (e.g., "when my parents argue I can't calm myself down"), controlling for temperamental negativity, predicted tenth graders' emotional reactivity in response to conflict with close friends (e.g., "I feel sad," and "I can't stop thinking about the problem"). In turn, emotional reactivity to close friend conflict predicted 11th graders' emotional reactivity to romantic partner conflict, which also was associated with the intensity of that conflict. Difficulty dealing with the emotional aspect of conflicts in the important relationships continuing or emerging in adolescence showed continuity, leading to difficulty with major social developmental tasks of the period.

Turning to even more negative adolescent outcomes, several studies have shown that difficulties with emotion regulation are associated with developing psychopathology, particularly depression and anxiety. For example, of seventh graders who reported on their emotions via an experience sampling method, those who reported less effective regulation of more intense, labile emotions

also reported more depressive symptoms (Silk, Steinberg, & Morris, 2003). Using the ineffective regulatory strategies of denial or rumination also related to depressive symptoms.

Continuing to examine the relation of emotion regulation and adolescent depression, adolescents in Fussner, Luebbe, and Bell's (2015) study performed two interaction tasks with their parents, first a positive one in which the family perceived themselves to be winning a trivia game, and then a more negatively-toned experience of discussing problem issues together. The adolescents' positive emotion was observed and self-reported. Youth who could not maintain positive emotion, or up-regulate during the second task, showed higher self-reports of depression. This emphasis on dealing with positive emotion is somewhat unique and would seem important to the study of adolescent depression (see also Davis & Suveg, 2014).

Moreover, new emotion regulation-related constructs become important at these ages: awareness of one's emotions, acceptance of one's emotions, and ability to maintain goal-directed behavior, along with more adult emotion regulation strategies, such as cognitive reappraisal and suppression of emotion. Such aspects of emotion regulation were negatively related to female adolescents' depression (Moradi Siah Afshadi, Amiri, & Molavi, 2017). Further, aspects of emotion regulation can work together: Girls' emotional awareness was associated with lower levels of depression via cognitive reappraisal (Eastabrook, Flynn, & Hollenstein, 2014).

Regarding other aspects of emerging psychopathology, anxious gradeschoolers and youth have reported less effective regulation of sadness and anger, as well as more dysregulation of both emotions (Hurrell, Houwing, & Hudson, 2017; Hurrell et al., 2015). More specifically, in their recent meta-analysis Mathews et al. (2016; see also Hurrell et al., 2015, 2017) confirmed that youth experiencing anxiety were less aware and accepting of their own emotions. Lack of awareness and acceptance of one's emotions, and inability to maintain goal-directed behavior were variously related to social, physical, and separation anxiety for 8- to 16-year-olds, both at the time and 3 years later (Schneider, Arch, Landy, & Hankin, 2018; see also Kranzler et al., 2016). Sendzik, Schäfer, Samson, Naumann, and Tuschen-Caffier (2017) also uncovered links from lack of awareness to depression as well as anxiety, especially for 8- to 12-year-olds.

Examining specific emotion regulatory strategies, Mathews et al. (2016) showed that anxious youth most utilize support-seeking and avoidant emotion regulation strategies (usually more common in early childhood), as well as maladaptive rumination and catastrophizing. They did not use reappraisal in an experimental exposure to threatening images or report using it as a strategy in their everyday life (Carthy et al., 2010). In sum, anxious adolescents' emotion regulatory strategies are less than optimal, perhaps perpetuating their discomfort.

Further, young adolescents' self-reports of "emotional self-control" and dysregulation were associated with academic involvement and alienation, negative life events, tolerance of deviance, perceived harm and risk of substance use, and positive prototypes of substance users in expected directions, and both directly and indirectly then related to externalizing and internalizing problems and positive well-being (Wills, Simons, Sussman, & Knight, 2016). Similarly, difficulties with emotion regulation, especially anger awareness and discomfort with emotional expression, have been both concurrently and longitudinally with adolescents' risky behavior, including hard drug use and number of sexual partners, as well as overall externalizing and internalizing behavior problems (Hessler & Katz, 2010). These studies mark the extreme negative outcomes of dysregulation for adolescents.

Few studies examine adolescents' emotion regulation and their academic success directly. However, sixth graders' social-emotional skills, including frustration tolerance, were related to seventh graders' mathematics and reading achievement (Oberle et al., 2014). Further, Ivcevic and Brackett (2014) have shown that skills in overcoming frustration and modulating emotional reactions were related to adolescents' academic recognitions, academic honors, grades, and satisfaction with school (see also Jones et al., 2015). Emotional

intelligence assessment (including management of emotions of self and other) was also related to fifth- and sixth graders' language arts grades (Rivers et al., 2012; see also Costa & Faria, 2015). More research in this area is warranted.

Summary of Outcomes for Emotion Regulation In summary, emotion regulation also supports social and school success across preschool through adolescence, as well as serving a protective function against behavior problems. Along with and closely related to emotional expressiveness (Cole, Martin, & Dennis, 2004), this aspect of emotional competence should be a central focus of support from parents and educators. Thus, educators could promote emotion regulation, in the service of both social competence and amelioration of problem behaviors.

Components of Emotional Competence: Emotion Knowledge

Children are interested in emotions as early as age 2 years. In spontaneous conversations, even young children talk about and reflect upon their own and others' feelings and discuss causes and consequences of their own and others' emotional experiences and expressiveness (Dunn, 1994). Emotion knowledge yields information about emotional expressions and experience in self and others, as well as about environmental events. It conveys crucial interpersonal information, guiding interaction. Inability to interpret emotions can make home, neighborhood, and classroom confusing places, hindering social and academic adjustment.

What are the components of emotion knowledge for children and adolescents? Early emotion knowledge is conceived of as understanding expressions and situations of emotion, whether typical or atypical (Bassett, Denham, Mincic, & Graling, 2012; Sette, Bassett, Baumgardner, & Denham, 2015; Pons, Harris, & de Rosnay, 2004). Even 2-year-olds begin to understand emotions in this manner (Fernández-Sánchez, Quintanilla, & Giménez-Dasí, 2015).

Thus, most preschoolers can infer basic emotions from expressions or situations. They tend to have a better understanding of happy situations compared to those that evoke negative emotions. They gradually come to differentiate among the negative emotions of self and other-for example, realizing that one feels more sad than angry, when receiving "time out" from one's preschool teacher. They also become increasingly capable of using emotion language – for example, reminiscing about family sadness when a pet died.

Furthermore, young children begin to identify other peoples' emotions even when they may differ from their own – for example, knowing that father's smile as he comes into the house means he too smells the aroma of sauerkraut. Toward the end of this period, they begin to comprehend complex dimensions of emotional experiences, such as the possibility of simultaneous emotions, and that emotions may wane with time. In sum, preschoolers across many cultures are becoming able to discern their own and others' emotional states, talk about them rather fluently, empathize with others' emotions, and begin to understand dissemblance (Denham, 1998; Pons et al., 2004; Sawada, 1997; von Salisch & Janke, 2010).

As children mature, they acquire more detailed and sophisticated conceptions of emotions. Intricate emotion knowledge blossoms as grade-schoolers first improve markedly in understanding that different events elicit different emotions in different people, and that enduring patterns of personality affect individuals' emotional reactions. Then, older children also come to understand more mental aspects of emotions, such as differing desires and beliefs can engender different emotions, and that emotions can be hidden (along with the display rules governing when to hide them). Finally, they better understand how to regulate emotions, that emotions may be mixed/multiple, that time changes emotions, and the elicitation of moral emotions (e.g, Zajdel, Bloom, Fireman, & Larsen, 2013). Pons et al. (2004) have shown that these developmental phases exist, cohere, and are hierarchical, building upon one another, with emotion knowledge increasing with age.

Further, stable individual differences have been noted (Pons & Harris, 2005; see Castro, Halberstadt, & Garrett-Peters, 2016, for a similar three-factor structure in third graders' emotion

knowledge). It should be noted, however, that the validity of such specific elements of emotion knowledge has not been extended to adolescence.

Outcomes of Emotion Knowledge or Its Lack

Preschoolers' Social Competence and Behavior Problems

Although there are developmental progressions in the various aspects of emotion knowledge, there also are marked individual differences in these developments. Preschoolers who apply their more substantial emotion knowledge in emotionally charged situations have contemporaneous and later advantages in peer interaction; they are more prosocially responsive to their peers, and rated as more socially skilled by teachers, and more likable by their peers (Alonso-Alberca et al., 2012; Castro et al., 2016; Deneault & Ricard, 2013; Denham et al., 2003; Denham et al., 1990; Parker, Mathis, & Kupersmidt, 2013; Torres, Domitrovich, & Bierman, 2015; Izard et al., 2001; Garner & Waajid, 2008, 2012; Sette et al., 2015). Moderators of this central finding should be examined. For example, Kuhnert, Begeer, Fink, and de Rosnay (2017) found emotion knowledge predicted later prosocial behavior only for girls aged 5–7 years.

Further, investigating more specialized social competence, Liao, Li, and Su (2014) found that young children's emotion recognition was associated with their tendency to predict reconciliation of characters in aggression stories. Relatedly, preschoolers' emotion knowledge was related to peer nominations of their taking a defender role in conflict (Camodeca & Coppola, 2016). Important buffers against aggression were supported by emotion knowledge.

Why is this general link found so robustly across decades of study and samples differing slightly in age and in socioeconomic makeup? The power of emotion knowledge appears substantial. It allows a preschooler to react appropriately to others, whether calmly or sympathetically, bolstering social relationships. Interactions with an emotionally knowledgeable agemate would likely be viewed as satisfying, rendering one more likable; for instance, emotion knowledge may allow the preschooler to interact more successfully when a friend gets angry, and talking about one's own emotions can facilitate negotiating disputes with friends. Similarly, teachers are likely attuned to behavioral evidence of such emotion knowledge – the use of emotion language, the sympathetic reaction, and to evaluate it positively.

Conversely, lack of emotion knowledge puts the preschooler at risk for aggression (Denham, Blair, et al., 2002; Di Maggio et al., 2016; Parker et al., 2013; Ren et al., 2016; Woods, Menna, & McAndrew, 2017) and internalizing issues, such as shyness, loneliness and peer victimization (Di Maggio et al., 2016; Heinze, Miller, Seifer, Dickstein, & Locke, 2015; Sette, Baumgartner, Laghi, & Coplan, 2016). In some cases, there is moderation by gender; for example, misattributing anger when other emotions were more correct was related to peer rejection and boys' aggression (Schultz, Izard, & Ackerman, 2000).

Other reports have noted a relation between deficits in emotion knowledge and ADHD diagnoses (Chronaki et al., 2015; Lugo-Candelas et al., 2017; Rodrigo-Ruiz, Perez-Gonzalez, & Cejudo, 2017). Importantly, relations between behavior problems and emotion knowledge are likely to be bidirectional. In one study, early hyperactivity contributed to emotion recognition problems, which then contributed to internalizing behavior problems (Castro, Cooke, Halberstadt, & Garrett-Peters, 2018; see also Strand, Barbosa-Leiker, Arellano Piedra, & Downs, 2015; Székely et al., 2014).

As an overall summary, Trentacosta and Fine's (2010) meta-analysis emphasized these relations of emotion knowledge to both social competence and externalizing/internalizing behavior problems. In terms of its relation with social competence, findings were consistent across nonclinical and clinical samples, ages three to 11 years, ethnicity, SES, emotion knowledge measure, social competence source/reporter, and concurrent/longitudinal association. Regarding externalizing and internalizing problems, findings were consistent across similar potential moderators. Such effects are also found cross-nationally (e.g., Lee, Eoh, Jeong, & Park, 2017).

Preschoolers' School Success

Increasingly, researchers also are confirming a link between early academic success and young children's emotion knowledge (Blankson et al., 2017; Garner & Waajid, 2008, 2012; Izard et al., 2001; Leerkes, Paradise, O'Brien, Calkins, & Lange, 2008; Torres et al., 2015). For example, emotion knowledge – but not emotion regulation – was related to preschoolers' pre-academic achievement (Leerkes et al., 2008; see also Garner & Waajid, 2008). Denham and colleagues' work (Bassett et al., 2012; Curby et al., 2015; Denham, Bassett, Mincic, et al., 2012; Denham, Bassett, Thayer, et al., 2012) also showed that emotion knowledge predicts later preschool and kindergarten school adjustment and academic success, both directly and indirectly. Importantly, g*rowth* in emotion knowledge predicted kindergarten reading achievement and engagement in school (Nix, Bierman, Domitrovich, & Gill, 2013; see also Torres et al., 2015).

These findings on preschool emotion knowledge's contribution to school success extend even further in time. Rhoades, Warren, Domitrovich, and Greenberg (2011) found that preschool emotion knowledge predicted first grade academic achievement, mediated by kindergarten attentional abilities. Similarly, Izard and colleagues have found evidence of a link between emotion knowledge and even later academic success in elementary school (Izard, 2002; Izard et al., 2001). Thus, children's ability to understand emotions, especially in context, plays an important role in their concurrent and later academic success. In fact, a recent series of meta-analyses (Voltmer & von Salisch, 2017) shows that emotion knowledge in preschoolers *and* gradeschoolers is related to academic achievement, school adjustment, and peer acceptance.

Like that with social competence, the link with school success bears consideration. Why would emotion knowledge contribute to school success? First, school success – being able to attend and cooperate, feeling good about school, remaining nonaggressive, and focusing on tasks – is carried out in a very social world. Understanding the potential barrage of one's own and others' emotions in the preschool classroom can make these socially-centered tasks easier, in that interactions are smoother and more personal resources are left to focus on more cognitive tasks.

Possible Contributors to Early Emotion Knowledge

Emotion knowledge are important for social competence, avoidance of behavior problems, and school success. But there also seem to be important potential foundations (or at least strong correlates) of such knowledge. For example, self-regulation, which has already been implicated here for its connection to emotional expressiveness and emotion regulation, quite often is related to emotion knowledge (Carlson & Wang, 2007; Denham, Bassett, Zinsser, & Wyatt, 2014; Gündüz, Yagmurlu, & Harma, 2015; Klein et al., 2018; Mann, Hund, Hesson-McInnis, & Roman, 2017; Martins, Osório, Veríssimo, & Martins, 2016; von Salisch, Haenel, & Denham, 2015; von Salisch, Haenel, & Freund, 2013).

Thus, both "cool" (e.g., inhibitory control, attention focusing, and shifting) and "hot" (e.g., delay of gratification) aspects of self-regulation may be important supports for the acquisition of emotion knowledge, at least contemporaneously. It is not hard to picture that inhibiting prepotent responses in situations where tasks are difficult or activate emotions, and shifting attention to emotional aspects of the situation, might allow one mental space to perceive one's own or others' emotions. However, consideration of emotion knowledge predicting aspects of self-regulation rather than the reverse should be considered. For example, preschoolers' emotion knowledge and a composite of working memory and inhibitory control were contemporaneously related at age 3, but each predicted the other between ages three and four (Rhoades et al., 2011; see also Ferrier, Karalus, Denham, & Bassett, 2018).

Verbal ability, especially receptive language, also has been implicated as related to young children's emotion knowledge. Recent research continues to corroborate the emotion knowledge/language association (e.g., Martin, Williamson,

Kurtz-Nelson, & Boekamp, 2015; Martins et al., 2016; Seidenfeld, Johnson, Cavadel, & Izard, 2014). In fact, Beck, Kumschick, Eid, and Klann-Delius (2012) extended this relation to examine various age-appropriate aspects of gradeschoolers' emotion knowledge (e.g., knowledge of mixed emotions, expressive emotion vocabulary, situation knowledge including questions about bodily sensations and thoughts during emotions) and language/literacy (e.g., narrative structure, reading comprehension). The two constructs created well-fitting latent variables that nonetheless were so highly correlated as to be better explained by a common factor. As noted by Martin et al., "Children who present with both language difficulties and behavioral disruption may be particularly vulnerable to emotion processing errors, as well as to missed opportunities to engage in social interactions and conversations that might support their growth in this area" (p. 33). The same could be said for children exhibiting difficulties with self-regulation; it is time to attend to these issues.

Gradeschoolers' and Adolescents' Social Competence, Behavior Problems, and School Success

Although emotion knowledge can be assessed in middle childhood (e.g., aspects of emotion knowledge referring to mixed or hidden emotion), there are few studies involving it and only two were found regarding adolescents. Specifically, Kuhnert et al. (2017) showed that 7-year-old girls' prosocial behavior observed during triadic observations was related to their emotion knowledge; Garrett-Peters, Castro, and Halberstadt (2017) demonstrated that gradeschoolers' emotion knowledge was related to teacher ratings of classroom adjustment (i.e., cooperation, assertion, self-control, lack of behavior problems). Further, Öztürk Samur (2015) found positive relations between age-appropriate aspects of emotion knowledge and lack of externalizing behaviors in Turkish 6- and 7-year-olds.

Sometimes emotion knowledge is aggregated with related constructs given investigators' theoretical foundations and empirical goals. For example, emotion knowledge, as a high-loading aspect of a social-emotional comprehension factor, was associated with teacher reports of greater social skills and fewer behavior problems for two samples of gradeschool children (McKown, Russo-Ponsaran, Allen, Johnson, & Warren-Khot, 2016). Early adolescents' emotional intelligence score (which included aspects of emotion knowledge and regulation) was associated with teachers' ratings of fewer behavior problems, more adaptive behavior, and better achievement in language arts, mathematics, and reading, as well as work habits (Rivers et al., 2012). In the only other study found that involved adolescents, Moradi Siah Afshadi et al. (2017) found that knowledge of negative and positive emotions was related to lessened incidence of depression for adolescent females.

Summary of Outcomes of Emotion Knowledge Taken together, these findings suggest that from preschool to adolescence, the ability to understand emotions facilitates positive social interactions, as well as school success, and that a deficit in this ability can contribute to behavioral and learning problems. Again, this component of emotional competence begs for deeper scrutiny by educators, and more research and better assessment for later ages are needed.

Pathways Among Components of Emotional Competence

As important as these relations are between each component of emotional competence and social competence or school success, these components also are likely to support one another as an interrelated network (Eisenberg, Sadovsky, & Spinrad, 2005). In fact, all aspects of emotional competence work together to promote children's school success (Denham, Bassett, Mincic, et al., 2012). Much more targeted research in this area, or easily culled results, has been done involving preschoolers, so that is the focus of the following. However, it is likely that these components of emotional competence are interrelated for older children as well.

As Cole et al. (2004) theorized and Denham, Bassett, Mincic, et al. (2012) demonstrated, emo-

tion regulation and expressiveness often operate in concert. Children with who experience intense negative emotions and are unable to regulate their expressions of such emotion, are especially likely to suffer difficulties in social relationships (Contreras, Kerns, Weimer, Gentzler, & Tomich, 2000). In contrast, however, even children who are high in negative emotionality are buffered from peer status problems by good emotion regulation skills, which parents and caregivers can teach them (e.g., Eisenberg et al., 1997). Emotion knowledge also may support positive, regulated emotional expressiveness, especially in predicting social competence and school success (Denham, Bassett, Thayer, et al., 2012; Denham, Blair, et al., 2002; Di Maggio et al., 2016).

In Denham and colleagues' study (Denham, Bassett, Mincic, et al., 2012), all these assertions were corroborated in person-centered analyses: 4-year-olds with more positive profiles of emotional expressiveness, emotion regulation, and emotion knowledge (along with more positive self-regulation and social problem-solving) did indeed show greater school success as evaluated later that school year and in kindergarten. The children with lower emotion knowledge, as well as less positive emotional expressiveness and emotion regulation abilities, were at risk for deficits in later school success; this group was comprised of more boys and children living in poverty than the other two groups. Person-centered views of emotional competence can be useful in determining the need to address these interconnected abilities in the classroom.

Indirect, mediational pathways are also possible; emotional competencies considered more foundational might have, along with their direct effects, indirect contributions to classroom adjustment and academic readiness via more overt behaviors. In one of the few studies examining how aspects of emotional competence may mediate one another in contributing to early school success, Denham, Bassett, Zinsser, and Wyatt (2014) found that emotionally negative/aggressive behavior mediated relations between aspects of emotion knowledge and both concurrent and later school adjustment. Further, emotion knowledge was related to observed emotion regulation and thence to classroom adjustment (see also the indirect relation of emotion knowledge deficits to teacher-reported anger/aggression in Di Maggio et al., 2016).

Further, it can be important to demonstrate relations among the aspects of emotional competence as outcomes in their own right. In a study of tantrums, preschoolers' self-reports of general sadness/distress were related to parents' reports of their distress in tantrums, via their lack of emotion knowledge. Parent reports of children's anger reactivity also were related to their anger in tantrums, mediated by general anger dysregulation. Finally, parents' report of the children's sadness/distress reactivity was associated with tantrum distress, mediated both by use of venting as means of coping with emotions and by dysregulated sadness (Giesbrecht et al., 2010). Thus, expressivity, emotion regulation, and emotion knowledge all showed relations. As another example, Lindsey (2017) noted the relation between young children's mutual positive affect and emotion knowledge. Finally, Hudson and Jacques (2014) showed that understanding emotions, in general, and display rules, in particular, contributed to 5- to 7-year-olds' abilities to aspects of emotion regulation during a disappointing gift task.

Summary of Relations Among Components of Emotional Competence In sum, emotional competence components do not operate in isolation. Peers and adult experience children's emotional competence skills working together during interaction and as supports for learning. Furthermore, emotional competence components also are related in a more variable-centered manner. This information could be very useful for programming. As well, more work with older children would be useful. It makes sense to now turn to means of promoting this "total package."

Socialization of Emotional Competence

All components of emotional competence are, then, extremely important as foundations for young children's social and academic success. How do

children become emotionally competent at an age-appropriate level – or not? They do not develop these competencies in a vacuum. In the social worlds of preschoolers and gradeschoolers, both parents and teachers/caregivers loom large as socializers, and both are likely to provide children experiences that promote or deter the development of emotional competence (e.g., both experience strong emotions during caregiving; Garner, 2010). As children move into adolescence, friends are more and more important as socializers of emotional competence, these relationships become ever more central (Miller-Slough & Dunsmore, 2016).

Parent Socialization of Emotion

Much is known about the contribution of *parental* socialization of emotion to their children's emotional competence (Denham, Bassett, & Wyatt, 2014; Eisenberg, Cumberland, & Spinrad, 1998) – their *model*ing of emotional expressiveness, *teaching* about emotions, and *reactions to* children's emotions. Parents' generally positive emotional expression (with "safe" expression of negative emotions), encouraging reactions to children's emotions, and openness to and expertise in talking about emotions, help their children become emotionally competent. Each aspect of socialization of emotion is considered here.

Further, beliefs about emotions are increasingly recognized as important to socialization of emotions (particularly acceptance of/attention to emotions and the value of emotions and their regulation; Meyer, Raikes, Virmani, Waters, & Thompson, 2014). Beliefs are related to actual enactment of socialization of emotion (e.g., parent-reported reactions to children's emotions, Halberstadt, Thompson, Parker, & Dunsmore, 2008; Halberstadt et al., 2013; Wong, McElwain, & Halberstadt, 2009; and observed family negativity, Wong, Diener, & Isabella, 2008).

Another important consideration is the potential reciprocal nature of emotional transactions between parent and child; children's emotionality undoubtedly affects parental socialization of emotion behaviors. For example, mothers' positive emotion during a waiting task, administered four times between 18 and 48 months, increased more over time *if* their children were less angry, more content, or engaged more in positive emotion regulation strategies (Cole, LeDonne, & Tan, 2013; see also Fields-Olivieri, Cole, & Maggi, 2017). Mothers' negative emotion decreased less when children were angrier than agemates (see also Premo and Kiel's (2014) findings of 2-year-old boys' support-seeking regulation strategies under low threat predicting mothers' more supportive reactions to their emotions at age 3; mothers' socialization behaviors could be seen as responses to their children's earlier emotional lives).

Parent Socialization of Emotion for Preschoolers: Modeling

Regarding modeling, parents' and children's positive emotional expression are significantly related (Davis, Suveg, & Shaffer, 2015a; Fields et al., 2017). Conversely, when mothers are often angry and tense with them, young children are angrier and less emotionally positive (Denham, 1998; Newland & Crnic, 2011). Maternal positivity (supported by positive beliefs about children's emotions) also contributes to Korean children's emotion regulation (Cho & Lee, 2015). Well-modulated negative emotion, however, may have positive effects (Denham & Grout, 1992).

Parental emotion regulation (as modeled regulated or dysregulated emotion) also is an important contributor to aspects children's emotional competence. Thus, parental dysregulation also contributes to children's emotion regulation and behavior problems, often in concert with aspects of family emotional expressiveness. For example, Are and Shaffer (2016) found that preschoolers' mothers who reported emotion dysregulation also reported less positive family expressiveness and more negative expressiveness. Maternal dysregulation directly predicted children's emotion regulation or negativity/lability, and indirectly predicted children's emotion regulation via lack of positive expressiveness (see also Ulrich & Petermann, 2017). In contrast, where maternal dysregulation was low, and children's own positive emotion was high, preschoolers' behavioral adjustment was facilitated (Davis, Suveg, & Shaffer, 2015b).

More specifically, parental use of certain emotion regulatory strategies can assist children in regulating emotions themselves. When mothers used attention refocusing, cognitive reframing, and comforting strategies during a disappointing gift task, their 4- to 7-year-old children did so as well. Further, mothers' attention refocusing (especially with preschoolers) and joint attention refocusing and cognitive reframing were related to lessened sadness and anger after the strategy use (Morris, Silk, Morris, Steinberg, Aucoin, & Keyes, 2011).

Examining another detailed aspect of parental emotion regulation, awareness of emotion, Brajsa-Zganec (2014) found that Croatian mothers' and fathers' awareness of their own and their preschooler's emotions were negatively related to the children's negativity, which was directly related to internalizing and externalizing problems. Fathers' awareness also was directly negatively related both types of behavior problems (mothers' only to externalizing). Similarly, Crespo et al. (2017) found that mothers' lack of awareness of their own emotions indirectly contributed to young children's internalizing and externalizing problems, via the children's difficulties with regulation. Maternal difficulties with emotion regulation also contributed to behavior externalizing and internalizing problems, mediated by children's negativity. Thus, children witness parents' abilities to regulate emotions, and consequently, parents' regulation or dysregulation contributes to children's own emotion regulation and behavior problems.

Parents' emotions are also associated with children's emotion knowledge (Watson & Nixon, 2001). Positive expressiveness in the family seems to promote emotion knowledge, perhaps because positive feelings render children more open to learning and problem-solving. Conversely, exposure to parents' negative emotions can hamper young children's emotion knowledge by upsetting them and making it difficult for them to self-reflect about issues of emotion (Denham, 1998; Denham, Zoller, & Couchoud, 1994; Raver & Spagnola, 2003). Exposure to *well-regulated* negative emotion, however, also can be positively related to this aspect of emotional competence (Garner, Jones, & Miner, 1994).

Parent Socialization of Emotion for Gradeschoolers and Adolescents: Modeling

No doubt parental emotions remain important as supports or detractors for their children's emotional competence at these older ages. Although there is somewhat less research at this age level than for preschoolers (perhaps because of changes in researchers' abilities to enter into family life), extant reports do paint a clear picture. For example, Duncombe, Havighurst, Holland, and Frankling (2012) found that 5- to 9-year-olds' parents' negative expressiveness related to their children's emotion dysregulation (i.e., negativity and lability).

Parental expressiveness and regulation are also related to adolescents' behavior problems. Parents' negative expressivity linked with their 16-year-olds' internalizing and externalizing (Stocker, Richmond, Rhoades, & Kiang, 2007; see also Yap, Schwartz, Byrne, Simmons, & Allen, 2010, who found mothers' negative expressiveness related to young adolescents' depressive symptoms via their emotion regulation). Adolescent anxiety may also be related to parents' lack of awareness of their own and their children's fear and anger (Hurrell et al., 2017).

Ability to move from negative to positive emotional expressiveness, adjusting emotions to situational demands – emotional flexibility – is also important. Living in an affectively negative, rigid environment can be harmful; compromised emotion regulation, sometimes with attendant symptomatology, can occur. For example, although families of children diagnosed with ADHD did not differ from those of nondiagnosed children in positive or negative expressiveness, they demonstrated less emotional flexibility (Van der Giessen & Bögels, 2018). In contrast, adolescent girls' and mothers' emotional flexibility – in an "emotional rollercoaster" task where they discussed five alternating negative and positive emotions in 15 min – was associated with fewer internalizing symptoms (Lougheed & Hollenstein, 2016).

As already noted, regulatory strategies can also be modeled. Regarding parents' specific emotion regulation strategies, their reports of

using reappraisal and suppression strategies predicted their reports of older children's using the same strategies 1 year later (Gunzenhauser, Fäsche, Friedlmeier, & von Suchodoletz, 2014). Further, dysregulated gradeschoolers' mothers endorsed using suppression and not using cognitive reappraisal to deal with their own emotions; more regulated children's mothers did not use suppression (Castro, Halberstadt, & Garrett-Peters, 2017). Both overall parental dysregulation and specific strategy usage are related to children's emotion regulation.

Experience sampling reports of youths' cognitive reappraisal and emotion suppression strategy usage showed relations with mothers' usage for younger adolescents and those reporting better mother-youth relationships (Silva, Freire, & Faria, 2018). Similarly, mothers who reported emotion suppression had adolescents who reported less awareness of their own emotions (Remmes & Ehrenreich-May, 2014). Adolescents are reflecting strategies that they observe in parents.

Fathers also may play a key role during this age range; reciprocal positive affect between fathers and their children predicted less emotion adolescent dysregulation reported by parents (and such emotion dysregulation predicted behavior problems reported by both parents and teachers, aggregated; Thomassin & Suveg, 2014). More socialization of emotion research specifically involving fathers is needed, echoing an oft-heard plea in developmental psychology.

Timing of emotions and behaviors also matters in socialization of emotion. Several researchers have begun to examine sequences of parent-child emotions, or parent-parent emotions. In one such study, gradeschoolers' mothers' and fathers' sequentially congruent positive affect (e.g., mother smiles, and then father smiles) during triadic reminiscing about sad memories uniquely negatively predicted their children's emotion dysregulation, which also mediated the association of maternal and child depressive symptoms (Thomassin, Suveg, Davis, Lavner, & Beach, 2017). More use of sequential and other temporal examination of emotions, of parents and/or their offspring, is called for (Lewis, Zinbarg, & Durbin, 2010).

Parent Socialization of Emotion for Preschoolers: Contingent Reactions to Children's Emotions

In terms of reacting to children's emotions, mother's supportive reactions (e.g., encouraging emotions, focusing on the problem or emotion) to children's emotions positively relate to preschoolers' expressiveness of positive emotions (Fabes, Poulin, Eisenberg, & Madden-Derdich, 2002) and emotion regulation (Meyer et al., 2014; Spinrad, Stifter, Donelan-McCall, & Turner, 2004). In contrast, parents using unsupportive reactions to emotions (e.g., dismissing, punishing, showing distress) are more likely to have sadder, more fearful children (Berlin & Cassidy, 2003), often with compromised emotion regulation (Luebbe, Kiel, & Buss, 2011; Woods et al., 2017). Parents' supportive reactions to children's emotions also may help the child in differentiating emotions (Denham & Kochanoff, 2002; Denham, Zoller, & Couchoud, 1994; Fabes et al., 2002; Fabes, Leonard, Kupanoff, & Martin, 2001).

As seen with modeling socialization of emotion, children's emotion regulation often mediates relations between parents' reactions to emotions and children's behavior problems. In Woods et al. (2017), for example, children's dysregulated emotion mediated the relation between mothers' nonsupportiveness and preschoolers' aggression.

Parent Socialization of Emotion for Gradeschoolers and Adolescents: Contingent Reactions to Children's Emotions

Parents' reactions to their children's emotions continue to be important to youth's emotional competence, as well as social competence and school success outcomes. In many studies, the contributions to children's emotional competence and social competence remain similar to patterns found in preschool. For example, Blair et al. (2014) found that maternally reported supportive and nonsupportive reactions to children's emo-

tions when children were 5 years old predicted (in expected directions) teachers' and mothers' reports of their emotion regulation at age 7, which then predicted children's reports of their positive and negative friendship quality at age 10. Thus, a successful emotional transition from preschool to middle childhood was promoted by maternal supportive reactions during the preschool period.

Such relations continue through the gradeschool period. For example, Han, Qian, Gao, and Dong (2015) found that maternal and paternal supportiveness were related to Chinese children's emotion regulation, and negatively related to their emotion dysregulation (see also Morelen, Shaffer, & Suveg, 2016, as well as Song & Trommsdorff, 2016, for similar findings with Korean families). In fact, in Han et al. (2015), parents' *lack* of supportive reactions mediated the negative association of parental emotion dysregulation with child emotion regulation. Similarly, mothers' nonsupportiveness mediated the relation between mothers' dysregulation and children's lability/negativity (Morelen et al., 2016; see also Ulrich & Petermann, 2017). Finally, parents' supportive and unsupportive reactions can predict children's specific strategy usage; parent's supportiveness predicted their gradeschoolers' use of reappraisal strategies, and nonsupportiveness their use of suppression strategies, 1 year later (Gunzenhauser et al., 2014).

Further, reciprocal and sequential relations remain important; Morelen and Suveg (2012) found that, during discussions about potentially difficult emotions, parents' supportive responses to children's observed adaptive emotion regulation led to their continued adaptive emotion regulation. The connection of parental reactions to children's emotions and children's emotion regulation is a crucial aspect of how emotional competence is socialized.

As with findings with parental expressiveness, supportive or unsupportive socialization of emotion also may be associated with children's behavior problems. For example, Yi, Gentzler, Ramsey, and Root (2016) found that gradeschool children showed more externalizing and internalizing problems when mothers were dismissing to their positive emotions; in contrast, those with lower self-control were buffered from externalizing problems when mothers encouraged positive emotions. At the same time, as with preschoolers and with modeling of expressiveness, relations between parental supportiveness or nonsupportiveness and internalizing/externalizing behavior problems may be mediational via children's emotion regulation (Jin, Zhang, & Han, 2017). Furthermore, such relations with behavior problems are also found for adolescents (e.g., Klimes-Dougan et al., 2007).

Some results are specific to particular emotions, and may be important for anxious children. Studying children from seven to 12 years old, some of whom had been diagnosed with an anxiety disorder, Hurrell et al. (2015) found that children's reports of inhibiting sadness, expressing dysregulated anger, lack of awareness of emotions, and reluctance to express emotions were related to mothers' less supportive reactions to their negative emotions. Fathers' nonsupportiveness was related to their children's difficulty regulating sadness.

Adolescent depression also is associated with parents' reactions to emotions. Lougheed, Hollenstein, Lichtwarck-Aschoff, and Granic (2015) found that maternal supportiveness of both positive and negative emotions was less likely when their adolescents evidenced more depression; Shortt et al. (2016) found similar relations between parental supportiveness and nonsupportiveness and depressive symptoms, especially for boys and fathers (see also Desjardins & Leadbeater, 2011; Jobe-Shields, Buckholdt, Parra, & Tillery, 2014). In sum, aspects of socialization of emotion are related to children's difficulties; even more longitudinal and observational sequential research would be very useful in zeroing in on directions of effects.

Validation and Invalidation

The use of one specific supportive reaction to children's emotions – validation (i.e., accurately and nonjudgmentally referring to the emotion or emotional perspective of the child – "I can see you're very angry") versus unsupportive invalidation (e.g., "You're not scared!") can be very

important. Lambie and Lindberg (2016) found that mothers' validation during a game positively, and their invalidation negatively, contributed to children's awareness of their own emotions (as part of emotion regulation).

In contrast, invalidation can lead to very negative results. Thus, in a study with gradeschoolers, Castro and colleagues (Castro et al., 2017) demonstrated that more labile (i.e., less regulated) children's mothers endorsed showing contempt to their children's emotions, as well as not valuing emotions. Buckholdt, Parra, and Jobe-Shields (2014) found that adolescents who felt that their parents invalidated their emotional expressions also were more likely to report internalizing and externalizing symptomatology, as mediated by their emotion dysregulation. Importantly, the adolescents' reports of invalidation were related to parents' own emotion dysregulation.

Also focusing on invalidation, Yap, Allen, and Ladouceur (2008) observed sequential patterns in of mother-adolescent interaction and obtained maternal reports of reactions to children's emotions. Similar to Lambie and Lindberg's (2016) findings with younger children, when mothers were observed to dampen their young adolescents' *positive affect* (e.g., displayed dysphoric affect when the adolescent showed positive affect) or espoused invalidation techniques (e.g., reprimanding, discomfort, or controlling the adolescent's positive emotions), their children displayed more emotionally dysregulated behavior during interaction and reported using more maladaptive emotion regulation strategies. Invalidation during the observed interactions and (for girls only) espousal of invalidation socialization also were related to depressive symptoms, mediated by adolescent use of maladaptive emotion regulation strategies. Thus, again, invalidation is particularly pernicious. Further, a focus on positive emotion is welcome, because of its potential protective function (Davis & Suveg, 2014).

Integrating Child Physiology

Examining supportiveness and nonsupportiveness as moderated by children's physiological responses to emotion-eliciting situations, especially as it contributes to youth psychopathology, has been the focus of several recent studies. Because of the level of detail required to explain the studies, only two with gradeschoolers are discussed. However, other work is emerging with preschoolers (e.g., Hastings et al., 2008; Perry, Calkins, Nelson, Leerkes, & Marcovitch, 2012; Scrimgeour, Davis, & Buss, 2016) and adolescents (e.g., Hastings, Klimes-Dougan, Kendziora, Brand, & Zahn-Waxler, 2014). This area merits much continued work.

Skin conductance level (SCL; in a negative context, increases in SCL are often interpreted as indicating emotional reactivity) and respiratory sinus arrhythmia (RSA; during a stressful event, RSA withdrawal marks mobilization of resources that support coping, whereas RSA augmentation reflects the maintenance of internal equilibrium and support for engagement) have been broadly used to reflect nervous system activity consonant with emotional experience.

For example, in a study with gradeschoolers with and without ADHD and their parents (Breaux, McQuade, Harvey, & Zakarian, 2018), children experienced two emotion-eliciting events, an impossible puzzle and social rejection task, and parents reported on the children's emotion regulation, 1 year after their parents had reported on their contingent reactions and reports on child symptomatology had been obtained from parents and teachers. Overall effects suggested that supportiveness was related to all children's later emotion regulation, as well as greater SCL reactivity for children with high ADHD symptoms. Nonsupportiveness was related to greater lability/negativity for children with high ADHD symptoms. It was considered that parents' supportiveness and nonsupportiveness were protective and risk factors, respectively, especially for the development of emotion regulation in youth with ADHD. The increased SCL for ADHD youth with supportive parents was seen as a positive response, because low SCL reactivity in response to challenge suggests a deleterious insensitivity to environmental stressors. Emotion socialization factors were not predictive of RSA here; RSA may fluctuate depending on the stressor and age of the children tested, illustrating the subtlety inherent in these studies.

McQuade and Breaux (2017) utilized similar methodology with parent-reported measures and gradeschoolers' experience of the emotion-eliciting task (social rejection) and physiological measurements. Physiological measures moderated the effects of parental report of contingent reactions on measures of adjustment. Supportiveness was more protective of children evidencing RSA augmentation in response to social rejection (perhaps a mark of lesser ability to mobilize resources in the face of the stressor), in terms of their emotion regulation, prosocial behavior, and peer rejection; these children may need and benefit from parental supportiveness. Children showing RSA withdrawal were relatively positive on outcome measures, independent of parents' socialization of emotion. Parental nonsupportiveness was more detrimental for children with low SCL reactivity in terms of their anger/dysregulation, aggression, and peer rejection. Nonsupportiveness was most deleterious for children showing RSA withdrawal, in terms of their aggression. Thus, physiological reactivity during social stress, as evidence of vulnerability, may work jointly with socialization of emotion, especially for preadolescents at risk physiologically, who may be most in need of parental supportiveness. These illustrative studies show how our knowledge base expands when physiology is included.

At this point, several specific issues surrounding parental socialization of emotion need to be reviewed: (a) child report of parent socialization; (b) developmental changes in socialization of emotion; (c) between- and within-parent inconsistency in socialization of emotion; and (d) cultural considerations. These considerations are placed here because of the importance of contingent reactions to children's emotions in each of the presentations.

Child Report of Parental Socialization of Emotion

Children can begin to report on their perceptions of socialization of emotion during gradeschool. Thus, Sanders, Zeman, Poon, and Miller (2015) found that children's views of their parents' nonsupportiveness were related to parents' evaluation of the children's anger dysregulation, less effective coping with anger and sadness, and depressive symptoms. Cross-informant reporting lends strength to these findings.

Extending this analysis to examine children's self-reported social competence, Sharp, Cohen, Kitzmann, and Parra (2016) found that children's perceptions of parents' discouragement and nonresponse to their sadness were indirectly related to classroom peer-reported popularity and self-reported loneliness, via children's self-perception of lower social competence. Active discouragement was also related to children's increased classroom popularity via their sadness inhibition. Thus, children perceive how their parents are socializing their emotional competence, and such perceptions appear crucially related to important outcomes, via their feelings about themselves and their emotions.

Developmental Changes in Socialization of Emotion

The general pattern found in already reviewed studies resembles that for preschoolers (often beginning with emotion socialization during preschool), with age-appropriate outcomes. However, as children age, the outcomes of varying aspects of socialization of emotion may change. Examining families with 3- through 6-year-olds, Mirabile, Oertwig, and Halberstadt (2018) found that parents' supportiveness (i.e., emotion- and problem-focused) was associated with adaptiveness of children's emotion regulation strategies, as well as their behavior problems, but only for 3- and 4-year-olds. The contribution for older children was in the opposite direction, and nonsignificant.

The idea that socialization of emotion techniques, especially supportiveness to children's emotional expressiveness, remain developmentally static, has not been challenged in this way until recently. Given a developmental perspective, however, socialization of emotion practices that have been considered adaptive for young children may become less developmentally appropriate, and even bear some relation to maladaptive outcomes; supportiveness does not fill the same function or convey the same message as

children age. For example, Castro et al. (2017) found that, although maternal reports of their supportive reactions to third grade children's emotions were associated with their own reports of the children's social skills, the opposite held true for teacher reports of social skills, and in fact mothers' supportive reactions were associated with teacher's reports of behavior problems. Similarly, although Miller-Slough, Dunsmore, Zeman, Sanders, and Poon (2018) found that supportiveness to gradeschool children's sadness reported by both parents was related positively to their reports of children's social competence, it was also positively related to their internalizing problems (when both parents were not supportive, levels of social competence were average and internalizing symptoms low). In another study, more labile gradeschool children had more supportive mothers (Rogers, Halberstadt, Castro, MacCormack, & Garrett-Peters, 2016). Finally, considering nonsupportive, negatively affective participations in discussions about children's sadness, having two similarly negatively responsive parents was related to *lower* externalizing in gradeschoolers (Poon, Zeman, Miller-Slough, Sanders, & Crespo, 2017).

Castro et al.'s (2017) findings first highlight contextual differences in the differing environments in which older children live, which vary considerably in the nature and intensity of demands made. Mothers could carefully support the emotions of children about whom teachers have concerns, but teachers may not see the improvements mothers do. Further, teachers and mothers may be attuned to differing aspects of social skills. Certainly, teachers' benchmarks regarding even the same social skills, managing as they do many gradeschoolers at one time, may differ from mothers'.

Most importantly, however, and consonant with the findings of all four studies mentioned here, continued parental emotional supportiveness may no longer always be developmentally appropriate – gradeschoolers (and, of course, adolescents) need to determine autonomously their own ways to manage emotions. They need to develop their own strategies for expressing and regulating emotions. At the same time, it may be developmentally appropriate to redirect or even disapprove of children's over-volatility or excessive dwelling on negative emotion.

Regarding parental emotion beliefs, new findings also show that their import changes with development. For example, beliefs that would seem to be consonant with negative child outcomes, such as believing that emotions are dangerous and that parents should *not* teach children about emotions, have been shown to relate to positive outcomes for older children, like being able to recognize parents' emotions (Castro et al., 2016; see also Dunsmore, Her, Halberstadt, & Perez-Rivera, 2009). Given that in these studies the emotion knowledge assessment was of parents' emotions, perhaps children whose parents consider emotions dangerous also become exquisitely sensitive to their parents' microexpressions. Further, in Garrett-Peters et al. (2017), expected relations of emotion knowledge with the belief that emotions are valuable did not obtain; perhaps in this case parents' valuing of emotions has become less useful, having been more useful for promoting younger children's emotion regulation, or, alternatively, this belief is still useful for aspects of emotion knowledge not measured in this study.

In short, future research should pinpoint developmentally appropriate responses to children's and adolescents' emotions. Changes in prediction by contingent reactions, as reported by Castro et al. (2017) and others, need to be further unpacked, understood, and compared to analogous results still finding "supportive" reactions to be useful for optimal development. Further, the importance of emotion beliefs is underscored here, and should be a continued focus.

Between- and Within-Parent Consistency as Socializers of Emotional Competence

Another important issue in the socialization of reactions to emotions is whether, and if so how, parents' socialization of emotion works in concert. Perhaps having one parent who behaves supportively is "good enough" for positive child outcomes (Poon et al., 2017), or having parents who engage in a range of positive and negative

emotion socialization practices, either within or across parents, could promote optimal outcomes in children's emotional competence and behavior problems. These possibilities are uncovered at several developmental periods.

Differences between parents in socialization of emotion has been found to be beneficial in one study. McElwain, Halberstadt, and Volling (2007) found that having one supportive and one nonsupportive parent was positively related to young children's emotion knowledge and lower peer conflict (boys only). Greater support by both parents was associated with less optimal functioning on these outcomes. Echoing arguments already suggested here, the authors speculated that high levels of supportiveness may shield children from emotionally challenging situations, hampering the ability to process emotional circumstances and learn about conflicts.

Regarding gradeschoolers, in Poon et al.'s study, having one parent who was engaged and showed positive responses during a discussion about their daughter's sadness was associated with better psychosocial functioning (i.e., higher social competence and less externalizing and internalizing) than when neither parent showed such responses. In contrast, boys were rated by parents as most socially competent when one was highly positively responsive (i.e., supported and positively expressive during the discussion of sadness) and the other negative (i.e., unsupportive and expressively negative). Thus, again, a diverse range of parental responses to children's emotions, rather than a uniformly supportive approach, may have the potential to facilitate children's social-emotional development. Children no doubt make note of these inconsistencies and may become more attuned to emotions as a result.

Although more study is needed, it may be that such findings are restricted to Western cultures. That is, where mothers were less supportive, and fathers were more supportive, Chinese preschoolers were rated as having more internalizing symptoms (Yu, Volling, & Niu, 2015); further, where mothers were less controlling (i.e., less nonsupportive) and fathers were more controlling, children were rated as having more externalizing symptoms. These authors point out that fathers do the disciplining in China, such that their reactions are most salient, especially when mothers' socialization of emotion seems subdued. In any case, mixed socialization of emotion messages does not appear salutary for young Chinese children as noted for US parents.

Turning from between-parent differences and similarities, examining consistency within parents can be important. For example, in Miller-Slough et al. (2018), families where fathers showed high supportiveness *and* nonsupportiveness had lower social competence but also fewer internalizing problems. Although that pattern is somewhat difficult to explain, perhaps being active in socialization of emotion is important – sometimes supportiveness is called for, but sometimes "nonsupportiveness" (e.g., punitiveness, dismissiveness) is also called for, especially for older children for whom standards of emotional conduct may be becoming more stringent.

In contrast, Mirabile (2014) found that a slightly different type of within-person inconsistency (i.e., negative expressiveness paired with punitive reactions to preschoolers' negative emotions – two perhaps contradictory manifestations of socialization) was related to internalizing and maladaptive regulation, but *also* to adaptive emotion regulation. In this case, depending on the child, perceiving a parent who shows negative expressiveness and also punishes the child for negativity could overarouse *or* motivate efforts to comply with the parent's push for the child to control their emotions. Again, "mixed messages" may capture certain children's attention and, for some, promote emotional competence. Much more work is needed to clarify these potential mechanisms and the boundary conditions under which differences between and within parents' socialization of emotion are beneficial or detrimental.

Cultural Considerations in Socialization of Emotion

All beliefs and practices associated with emotions are created and interpreted within cultural and historical, socially embedded, contexts, such as the situational ecologies in which emotions

and interactions actually occur, and the criteria for interpreting social-emotional events (De Leersnyder, Boiger, & Mesquita, 2015). Thus, socialization of emotion is situated within every culture's narrative regarding the child outcomes that are most valued, and the best ways to reach these outcomes. This section is a short summary of, and examples of, ways in which culture matters to socialization of emotion.

Friedlmeier, Çorapçı, and Cole (2011) have put forward clear descriptions of how and why preferred modes of socialization of emotion will differ across cultures valuing individualistic or relational emotional competence (whether based on nationality or ethnicity). In this chapter the research described generally emanates from Western, individualistic, cultural values. These values permeate the very conceptions and expected outcomes of supportive and unsupportive reactions to children's emotions already described here, as well as the components of coaching and even of modeling of emotional expressiveness (i.e., discussing and coaching emotions, being aware of children's emotions, being mostly emotionally positive, using care when expressing negative emotions). In contrast, within relational cultures, socialization of emotion is often informed by the need to consider the interpersonal group and its needs, rather than the individual child's. Such values may emphasize *not* encouraging emotional expressiveness – in fact, punishing it; negative expressiveness may be used more liberally to inform children of their need to refrain from their own expressiveness. Emotions may not be discussed because they need to be suppressed. Finally, child outcomes of such socialization of emotion messages may be positive where Western thinking would predict them to be negative. For any cultural narrative, it is imperative to understand *what matters.*

However, parents in more relational cultures, like their individualistic counterparts, do sometimes also endorse reactions that are attuned to the child's individual needs. Although American, Turkish, and Romanian mothers reported many differences in their preferred modes of reacting to their toddlers' differing emotions (e.g., US mothers endorsed discipline to cope with anger, whereas those from the more relational nations emphasized reasoning), all endorsed comforting their toddlers' fear and helping them solve problems related to anger (Çorapçı et al., 2018). Some goals may be more universal.

Thus, despite some similar emotion-related behaviors, and even though in quite a few cases outcomes of contingent reactions to children's emotions are similar in both individualistic and relational cultures (e.g., in Yu et al., 2015, where fathers' controlling responses to children's emotions were related to children's behavior problems), there are many cultural differences in both endorsement of socialization of emotion strategies and concomitant outcomes. For example, Indian immigrant mothers were more likely than US mothers to endorse minimizing children's emotions (probably because of their disruption to collective harmony), but this practice was not related to child outcomes as it was for US mothers (McCord & Raval, 2016).

In other studies, child outcomes were opposite to those expected from the Western view of socialization of emotion (e.g., Louie et al., 2015). As an example, Jin et al. (2017) found that *only* when mothers were more controlling regarding their preschoolers' positive emotions, the children's emotion knowledge was associated with lower behavior problem and higher social competence scores. These investigators suggest that the Confucian heritage prioritizes relational socialization of emotion, whereby children who embody modesty, and in this case also are more knowledgeable about emotions, are viewed as more competent.

Further, even within the USA the injunction "know what matters" holds true. Parents in cultural groups based on ethnicity hold different values, compared to European American parent, which impact the nature and outcome of socialization of emotion. For example, Nelson et al. (2013) found that European American mothers using problem-focused reactions to their children's negative emotions, helping them to solve the problem, had children whose kindergarten teachers evaluated as more academically and socially competent. This finding would be expected from the "standard" Western view. In

contrast, African American mothers' *lack* of encouragement of emotions (e.g., *not* endorsing "it's OK to cry when you feel unhappy") predicted these types of competence; controlling emotions may adaptive in a discriminatory society. Further, Pintar Breen, Tamis-LeMonda, and Kahana-Kalman (2018) found that Latina immigrant mothers' supportiveness was associated with their preschoolers' emotion knowledge, but that their nonsupportiveness was also (marginally) positively related. The cultural value "respeto" emphasizes children's obedience and proper demeanor, within an affectionate atmosphere. Given these findings, investigators suggested that what is generally termed *non*supportiveness may have a different meaning in this group; that is, reflecting "respeto," Latina mothers exhibit a mixture of warmth and control when responding to their children's emotions, and children, seeing this as normative, glean information about the nature of their emotions (see also Fiorilli, Stasio, Chicchio, & Chan, 2015, who found Chinese mothers to demonstrate high scores on both coaching and dismissing approaches to children's emotions – somewhat similar values of emotional restraint within care and affection also may be operative).

Thus, attention must be paid to make our conceptualiz]ation and measurement of socialization of emotion culturally sensitive, informed by the entire corpus of belief that undergirds a culture's view of emotion. That is, conceptualizing what is optimal socialization of emotion is to an extent culturally relative, such that care needs to be taken to know from a culture's perspective, what are the goals for socialization of emotion, and measurement needs to refer to emotional situations and parental reactions that make sense in a given culture.

Parent Socialization of Emotion for Preschoolers: Teaching

In its simplest form, teaching about emotion consists of verbally explaining an emotion and its relation to an observed event or expression. It is not surprising that adults' tendencies to discuss emotions, and the quality of their communications about emotions, if nested within a warm relationship, assist the child in expressing emotions (Denham, Cook, & Zoller, 1992). Such scaffolded teaching about emotions may help to direct children's attention to salient emotional cues, helping them understand emotional interactions and manage their own responses. At the same time, emotion conversations with parents allow children to separate impulses from behavior, giving them reflective distance from feelings, and space in which to interpret and evaluate feelings' causes and consequences, fostering both emotion knowledge and regulation (Brown & Dunn, 1992; Denham & Grout, 1992; Denham, Renwick-DeBardi, & Hewes, 1994; Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991; Garner, Dunsmore, & Southam-Gerrow, 2008). The general trend of these findings also holds true for low-income, minority families (Garner, 2006; Garner, Jones, Gaddy, & Rennie, 1997).

The benefits of such teaching and coaching can begin quite early, and the co-action of parent and child may be crucial. When parents elicited toddlers' labels and causes for emotions in a storybook task, children helped and shared more quickly and more often in experimental tasks (Brownell, Svetlova, Anderson, Nichols, & Drummond, 2013; see also Drummond, Paul, Whitney, Hammond, & Brownell, 2014). It is important to note that in this study parents' own labeling and explaining were not associated with toddlers' prosocial behaviors. Further, questions can be important elements in emotion teaching and its promotion of preschoolers' emotion knowledge (especially girls; Bailey, Denham, & Curby, 2013) – they push children to think and formulate thoughts about the conversation's emotional content, to practice using challenging language, and to put emotional memories and experiences into words (Salmon & Reese, 2016). Thus, parents who can ensure children's engagement in the emotional conversation, and co-construct emotional meaning, may stand the best chance of promoting young children's emotion knowledge (Brownell et al., 2013; Laible, Panfile Murphy, & Augustine, 2013).

Parent Socialization of Emotion for Gradeschoolers and Adolescents: Teaching

Parents' emotion teaching and coaching continue to be important to youth's emotional competence, as well as social competence, remission from or lack of behavior problems, and school success. For example, Dunsmore, Booker, Ollendick, and Greene (2016; see also Dunsmore, Booker, & Ollendick, 2013) found that, where parents engaged in emotion coaching before a treatment program for children with oppositional defiant disorder (e.g., discussing causes and consequences of emotions during discussions of emotion memories), children high in mother-reported negativity/lability were especially less likely to show disruptive behavior problems post treatment. The coaching predicted greater change for those most at risk. Similarly, Duncombe et al. (2012) found that coaching *beliefs* (e.g., considering the child's negative emotions as teachable moments) were related to early gradeschoolers' emotion regulation, and hence to fewer behavior problems. Regarding adolescents, mothers' emotion coaching of anger was related to better anger regulation in adolescent siblings, which was in turn related to less externalizing behavior (Shortt, Stoolmiller, Smith-Shine, Mark Eddy, & Sheeber, 2010).

It is important to explore the potential mechanisms accounting for such findings. Thus, other researchers have examined how teaching about emotions specifically transpires in mother-child dyadic conversations. During reminiscences about emotions, mothers of anxious children, compared to those of nonanxious children, spoke less frequently, were less elaborative in what they did say, used fewer positive emotions words, and/or discouraged their children's discussion (Brumariu & Kerns, 2015; Suveg et al., 2008; Suveg, Zeman, Flannery-Schroeder, & Cassano, 2005). In Suveg et al., fathers also explained less about emotions and were less emotionally positive with sons. The children who were more anxious (or diagnosed with anxiety disorder) showed less positive affect and engaged in fewer problem-solving emotion regulation strategies when discussing anxious or angry situations; they were also found to be more affectively intense, with more misfit between their emotion and the discussion (Brumariu & Kerns, 2015). Direction of effect is always difficult to project when constructs are measured simultaneously, but at the very least, in families where children are anxious, parent-child communication about affect is non-optimal, and parents do not appear to support emotional competence. These findings bear extension due to their family and clinical implications.

Summary: Parent Socialization of Emotion

In sum, parental (mostly maternal) socialization of emotion – modeling, contingent reactions, and teaching – contributes much to all components of emotional competence, as well as to social competence and behavior problems. Further, new information exists on the import of children's report of parent socialization, developmental changes in socialization of emotion, between- and within-parent inconsistency in socialization of emotion, and cultural considerations.

But what about the influence of friends, and of teachers in the classroom? Their contribution could be extremely important, in the same or new and different ways.

Friend Socialization

Although much research is emerging since Denham, Bassett, and Wyatt's (2014) call for more investigation of how friends might socialize each other's emotional competence, the preponderance of research still considers the socializing behaviors and beliefs of parents. However, especially as children reach an age where peers assume pivotal importance in their lives, friends should be considered as potential socializers of emotional competence as well (Miller-Slough & Dunsmore, 2016; von Salisch & Zeman, 2018).

With friends, emotional expressiveness and experience, emotion regulation, and emotion

knowledge of two individuals in a similar developmental context may become related as intimate interactions transpire over time. Relationships between friends are horizontal ones, unlike the vertical parent-child relationship. Neither member has more expertise or power, making friendship ripe for co-socialization of emotion. In fact, the experience of having friends, with whom one shares feelings, can afford an avenue toward emotional competence, and vice versa.

Thus, in a longitudinal study examining friendship dyads, young adolescents with more reciprocal friends reported using fewer aggressive anger regulation strategies (e.g., verbal and relational aggression, revenge fantasies), and more frequently using reappraisal of anger-eliciting events, across two different lagged time periods (von Salisch & Zeman, 2018). Earlier, these researchers uncovered the opposite direction of effect – constructive anger regulation via redirection of attention, use of social support when angry, and willingness to self-disclose emotions (for girls only) predicted more reciprocal friendships at a later measurement. Thus, having friends promoted, and was promoted by, emotional competence involving more optimal emotion regulation strategies (von Salisch, Zeman, Luepschen, & Kanevski, 2014).

In fact, relations between friendship and emotional competence may be more complex than even these depictions. That is, von Salisch (2018) has uncovered upward and downward spiral effects, with adolescents more willing to self-disclose emotions at the beginning of the study having more friends at the second time of measurement, leading to more self-disclosure at the third measurement – an upward spiral. In contrast, adolescents with less adaptive coping with sadness and tendencies toward social isolation were likely to have fewer friends at the second assessment, with intensified reclusive tendencies at the third measurement – a downward spiral.

Along with associations between *having* friends and components of emotional competence, adolescent friends begin to fulfill the function of emotional supportiveness, just when parents' supportiveness may become more variably facilitative. Good friends, especially girls, are more likely to be supportive than unsupportive in response to friend's emotions, and feel free to express emotion with each other (Glick & Rose, 2011; Klimes-Dougan et al., 2014).

Other reports of friends' socialization of emotion show impacts of such supportiveness and nonsupportiveness. For example, aspects of friends' supportiveness were associated with lower externalizing, whereas aspects of friends' nonsupportiveness were associated with greater internalizing and externalizing (Klimes-Dougan et al., 2014). Further, friends' supportiveness has been linked to fewer symptoms of depression (e.g., Desjardins & Leadbeater, 2011). Friends' supportiveness may become more developmentally salient than parents', and related to positive outcomes, as the focus of social-emotional development shifts to the broader social world.

Along with supportive and unsupportive reactions to friends' emotions, friends may also model expressiveness, not always with salutary outcomes; friends may become more similar in terms of depressed affect (Giletta et al., 2011; Kiuru, Burk, Laursen, Nurmi, & Salmela-Aro, 2012). At times, depressive symptomatology also can impede friend supportiveness; Lougheed et al. (2016) found friend supportiveness to positive emotion was lower for depressed adolescents.

Regarding coaching one another about emotions Legerski, Biggs, Greenhoot, and Sampilo (2015) worked from the premise that friends' use of emotion terms during conversations may provide a means to convey emotional meaningfulness of events and circumstances, a shared sense of emotional support and arena for growth in emotion knowledge. These investigators noted dyadic similarity in the use of positive and negative emotion terms during discussions of personal problems. When friends responded to their partner's emotion talk supportively and not dismissively, self-disclosure in subsequent utterances increased. Sharing of emotions, discussing how to deal with them, can be a very important component of adolescent friendship.

Discussion of emotion can become complex during this age range. Rumination is the repeated and prolonged discussion or thoughts about negative circumstances. Its import is somewhat

unclear, and whether it has positive or negative ramifications may differ depending on when it occurs in development (Cole, 2014). It has been related to mothers' affection and supportiveness (Stone et al., 2017); perhaps feeling secure that feelings are fertile ground for discussion can lead the sensitive adolescent to continue a vicious cycle of thought and feeling (e.g., "why didn't *he call me*????"). Friends' pronounced co-rumination during adolescence has been related to increased depression and anxiety and ultimately, lessened friendship quality, but also to enhanced friendship quality (Rose, Schwartz-Mette, Glick, Smith, & Luebbe, 2014). Some associations are gender-dependent; overall, co-rumination appears more positive for boys than girls. However, greater clarity is needed on how co-ruminating adolescents may socialize each other's emotional competencies, as well their externalizing and internalizing problems. In sum, findings on friend's socialization of emotional competence are emerging, with upcoming findings eagerly anticipated.

Teacher Socialization of Emotion

After considering parental and friend socialization of emotion, it follows that *teachers'* socialization of emotional competence will also promote social-emotional and even academic success in school. The literature is rather sparse on this aspect of socialization, and what little exists almost unanimously refers to preschool education. Thus, what is known will be reviewed here, along with ideas of how to assist teachers in becoming better socializers of emotion (ideas that could potentially be useful to parents, as well).

During the preschool period, contexts outside the family become important for children's development. Preschool is rich in emotional experiences, and young children learn about emotions through daily interactions with teachers and peers. In addition, even when children are not directly involved in an interaction, they learn about social and emotional by observing social-emotional behaviors of peers and teachers. Thus, recent research has identified preschool teachers as pivotal facilitators of the development of children's social-emotional competence (Denham, Bassett, & Zinsser, 2012); for example, high levels of teacher emotional support and positive emotional tone in the classroom are related to better social-emotional outcomes for children (Curby, Brock, & Hamre, 2013; Spivak & Farran, 2016).

Most research, however, focuses on teachers' overall abilities to provide an emotionally supportive environment in the classroom, not their discrete emotion socialization behaviors. This lack should be rectified, because early childhood education research indicates that preschool teachers are likely to engage in a wide variety of specific emotion socialization behaviors in the classroom, parallel to parental emotion socialization behaviors (Ahn & Stifter, 2006; Ersay, 2007). For example, teachers show emotions and react to children's emotions in ways like parents (Denham, Bassett, & Zinsser, 2012). They also use emotion language in the classroom, although relatively infrequently (Yelinek & Grady, 2017); they explain and question during teacher-led activities and use socializing and guiding language during free play (e.g., "we smile when we say hello," "you can pound these blocks if you're mad"), especially when it is aggressive.

In short, given the relative abundance of literature on parents' roles in socialization of emotion, as well as similar roles that parents and teachers have as socializers and the increasing time children are spending in group settings, it can be assumed that there is a fundamental relation between early childhood teachers' socialization and young children's emotional competence. Different emotions and reactions to children's emotions during interactions are likely to send different socialization messages about specific emotions and emotion-related behaviors to children in the classroom, just as they do in the home.

Some early childhood teachers are already intuitively aware of the importance of their own emotions, as well as children's, to learning and well-being and closely attend to these issues in the classroom (Zembylas, 2007; Zinsser, Denham, Curby, & Shewark, 2015; Zinsser, Shewark, Denham, & Curby, 2014). But preservice teachers report little training on developing

emotional competence in students or managing their own internal feelings and external displays of emotion (Garner, 2010; Poulou, 2005; Schonert-Reichl, Kitil, & Hanson-Peterson, 2017), and relatively few schools of education are prepared to train teachers on these matters (Schonert-Reichl et al., 2017). Moreover, there are individual differences in teachers' enactment of best practice in this area (Zinsser et al., 2014, 2015). Encouraging research is, however, emerging suggesting that emotional competence concepts can be successfully infused in an undergraduate course on curriculum and instruction (Waajid, Garner, & Owen, 2013). Even greater understanding of teacher socialization of emotion in early childhood education could lead toward needed developments in teacher preservice/in-service training.

But what *is* actually known about teacher socialization of emotion? Given the parent literature on how emotional competence is socialized, informed predictions can be made about the contributions of early childhood teacher socialization. Their modeling, reacting, and teaching are likely to contribute to young children's emotional competence, and directly and indirectly (via children's emotional competence) to children's early school success. Recalling findings on parents' emotion regulation, teachers' own emotional competence is likely to be key.

Teachers' Own Emotional Competence

The ways in which teachers deal with their own emotional lives – perceiving emotions of self and others, using emotions to facilitate cognition and action, understanding emotions, and managing them – undoubtedly contribute to their socialization of pupils' emotional competence (Brackett & Katulak, 2006). For example, preschool teachers' emotional competence is related to their reactions to children's emotions; in Ersay's work (2015), preschool teachers with low awareness of their own emotions were less likely to self-report that they would help children label and regulate their emotions, or to try to help solve the problem. In Ersay's earlier (2007) work, teachers low on emotional awareness more often ignored children's emotions, and less often comforted children's negative emotions or matched their positive emotions. Further, teachers' reports of their own negative emotional intensity were associated with their punishing of children's emotions, and lack of attention to their own emotions was related to their greater minimization of children's emotions.

Given such circumstances, and because teaching can be emotionally draining and unpredictable (Jeon, Hur, & Buettner, 2016), it would beneficial to help teachers to become more emotionally competent themselves. Jennings and Greenberg (2009) suggested ways to promote teacher emotional competence, including mindfulness training, reflective supervision, stress reduction and direct training. In fact, Kemeny et al. (2012) have shown that mindfulness training does promote teachers' own emotional competence, with lasting effect.

Teacher Socialization of Emotion: Modeling

It is expected that teachers' positive expressiveness would be positively related to children's emotional competence in the classroom: their positive expressiveness, emotion regulation, and understanding of emotions. Specifically, teachers' positive emotionality would help children express and experience calmer, more regulated positivity themselves, and render them receptive to learning about emotions and broader topics. In contrast, intense teacher negativity would create an atmosphere where regulation is difficult. Mild teacher negativity might help children learn about emotions, but inexpressive teachers would not provide a welcoming platform for such learning.

Despite these predictions, very little research has yet targeted expressive modeling by teachers. Recent work suggested that teachers' negative expressiveness was negatively related to older preschoolers' positivity during peer interaction (Morris, Denham, Bassett, & Curby, 2013). Ongoing results go further to suggest that when teachers in the USA and Italy show predominantly positive emotions, so do the children in their classrooms (Denham et al., 2016).

To promote children's emotional competence, teacher training could focus on helping teachers

to be willing to show emotions, remain emotionally positive in the classroom despite challenges, and modulate understandable negative emotions (Zinsser et al., 2014, 2015). Promotion of the teachers' own emotional competence also could be useful for their modeling, increasing their abilities to accurately express emotions, generate positivity, reflect on, and manage emotions. Mindfulness techniques could help teachers maintain positivity, and reflective supervision could help teachers gain access to and understand their own emotions.

Teacher Socialization of Emotion: Reactions

It is expected that teachers' supportive reactions to children's emotions would be positively related to children's positive expressiveness, ability to regulate emotions, and their emotion knowledge, with the converse true for their punishing or minimizing reactions. Encouraging responses from teachers would assist children in tolerating and regulating emotions, teaching them that emotions are moments for sharing, manageable, and even useful. Finally, supportive reactions would help children "stay in the moment" to learn more about emotions. Adaptive responses to children's emotions would also support their social competence and academic success.

Even very young children do notice teachers' reactions to their emotions. Dunn (1994) found that young children absorb not only content, but also form and quality, of teachers' emotional support during child care transitions. Ahn and Stifter (2006) described such contingent responding to children's emotions; teachers encouraged positive emotional expression and responded empathically to it. In response to children's negative emotional expressions, they demonstrated empathy, physical comfort, distraction, problem-solving, ignoring, and negative responses such as restriction, threatening, ridicule, or minimization.

Further, teacher responses to child emotions differ by child age. More socialization reactions are targeted at younger than older preschoolers (Kiliç, 2015). In Ahn's work (Ahn, 2005; Ahn & Stifter, 2006), toddlers' teachers were more encouraging, and used physical comfort and distraction in response to children's negative emotions more often than preschool teachers, who relied more on verbal mediation. Ahn's work also demonstrates that early childhood teachers do not validate children's negative emotion very often – one of the major tenets of emotion coaching. However, when they do validate that emotions are okay to feel and express, observers report greater prevalence of positive emotion and prosocial behaviors in the children (Karalus, Herndon, Bassett, & Denham, 2016). In contrast, early childhood teachers in this research were also very focused on having their students develop independent emotion regulation (Ahn, 2005; Ahn & Stifter, 2006; see also Karalus et al., 2016).

Building on these descriptions, Bassett et al. (2017) found that teachers' supportive, nonsupportive, and validating reactions to preschoolers' emotions contributed to children's negativity and emotion regulation, in expected directions, but particularly for those with low surgent temperaments. Morris et al. (2013) also showed that teachers' dismissing reactions were negatively related to older preschoolers' positive expressivity and emotion knowledge. Finally, accepting beliefs about children's emotions and perspective-taking ability promote teachers' supportive reactions to children's emotions (Swartz & McElwain, 2012).

To promote this aspect of socialization of emotion, teacher training could focus on ways of assisting teachers in valuing their supportive role concerning children's emotions and give them specific strategies to use in reacting to children's more difficult emotions (e.g., anger, fear, sadness, even over-excitement). Promoting teachers' own emotional competence would likely assist them in utilizing emotional encounters more advantageously. Stress reduction could help teachers in their expression of supportive reactions to children's emotions.

Teacher Socialization of Emotion: Teaching About Emotions

It is expected that teachers who discuss emotions give children tools to use in expressing/regulating emotions. Via such direct, not misleading or idiosyncratic, tutelage, teachers could help children learn about emotions. Finally, children with

teachers more willing and adept at teaching about emotions would be seen as more socially competent and ready to learn.

Ahn (2005) conducted qualitative observations of which teachers' emotion-related discourse with children. Their emotion-related discussions in preschool classrooms, as opposed to toddlers', more frequently helped children infer causes of their negative emotions and taught them constructive ways of expressing negative emotion. Preschool teachers who value teaching children about emotions also promote children's more adaptive emotion regulation patterns (Denham, Grant, & Hamada, 2002). Moreover, Kolmodin (2007) found individual differences in in teachers' (not unlike parents') propensity to talk about emotions with preschoolers.

These values and propensities for emotion talk can translate into classroom and parenting practice. Several picturebook-reading styles of preschool teachers have been identified, which relate positively to children's emotion knowledge (Bassett, Denham, Mohtasham, & Austin, 2016). For example, children whose teacher used more questions for explaining causes and consequences of characters' emotions (e.g., "Do you think she is sad because the ball fell in the river?") showed greater growth in emotion knowledge than those whose teachers did not.

Promoting teachers' own emotional competence also could improve their ability to perceive emotions accurately, so that they could usefully talk about them with children. Use of reflective supervision could also aid teachers in giving them access to emotion vocabulary and increasing their ease in discussing feelings. Further teacher training could focus on ways of helping teachers to value teacher-child emotion conversations and sustain interchanges about emotions in classroom activities and dialogues about ongoing classroom interactions.

Summary and Looking Forward: Teacher Socialization of Emotion

These initial research efforts require extension. More details are required. Examining microlevels of teachers' emotion socialization behaviors in the classroom could further understanding of socialization of emotion in classrooms. Knowing the relations of their discrete emotion socialization behaviors with children's developing emotional competence could be very useful for teacher training.

Further, recent research suggests that continued study should also attend to aspects of teachers' lives that could promote their abilities as socializers of emotional competence: well-being (e.g., the balance of their job resources and demands, wages, and perception of being able to pay for their basic expenses; Cassidy, King, Wang, Lower, & Kintner-Duffy, 2017; Denham, Bassett, & Miller, 2017; King et al., 2016); their own emotional competence (e.g., Swartz & McElwain, 2012), and experience (Denham et al., 2017). At the same time, training needs need to be improved, including adequate preservice on the topic (Buettner, Hur, Jeon, & Andrews, 2016; Garner, 2010; Schonert-Reichl et al., 2017), in-service training, and professional development regarding evidence-based practices (Steed & Roach, 2017).

Educating for Emotional Competence

Knowing the importance of children's emotional competence and the contributions of adults' socialization, mention of how successfully this is dealt with in schools (both programming and assessment), as well as support for parents, should be briefly discussed. First, an integrated system of educational practice is recommended; Denham (2015) has described such a system. As noted when this chapter began, age-appropriate developmental *tasks* are the substrate upon which specific emotional competence *skills* are demonstrated and developed; (b) *standards* are created emanating from these important competencies as road maps of what skills to look for, expect, and teach; (c) standards inform choice of *assessment* tools, and vice versa; (d) both standards and assessment are useful in that they lead to *instruction* (which often leads to the need for further, regular assessment and revised standards, and can be supported by both professional development for teachers as emotion socializers, as well as curriculum or less structured program-

ming; see Humphrey, 2013); and (e) finally, educators strive to promote growth in children's emotional competence. In this chapter, instructional programming and assessment are briefly considered.

Effective Emotional Competence Programming

Several meta-analyses have noted the efficacy of programming for social-emotional learning (which includes the components of emotional competence; e.g., Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Sklad, Diekstra, Ritter, Ben, & Gravesteijn, 2012; Taylor, Oberle, Durlak, & Weissberg, 2017). Durlak et al. showed that the reviewed programs showed improvement compared to control groups in social-emotional skills, behavior problems, and academic performance (see also Sklad et al., 2012). The benefits of programming held true from kindergarten through high school, and in urban, suburban, and rural schools. Benefits were as great in teacher-led as in researcher-led programming, but documentation of appropriate, accurate implementation of any program is key. Taylor et al. (2017) gave evidence that the programs' benefit for social-emotional skills, behavior problems, and academic performance was significant at follow-up periods from 6 months to 18 years, and that benefits did not vary by students' race, SES, or geographical location. Moreover, there were significant positive effect sizes for outcomes such as school attendance, dropout, safe sexual behavior, and juvenile justice involvement. Thus, social-emotional programming works (although this statement is not without some controversy; Humphrey, 2013). The crucial skills covered in this chapter can be promoted.

There are several criteria for quality programming in emotional competence. Durlak et al. (2011) summarize these by the acronym SAFE: (a) sequenced, lessons are connected and coordinated, consistent in providing clear objectives and activities, clear in their contribution to the overall program goals; (b) active, active learning approaches rather than lecture or other passive modes of learning are used; (c) focused, any useful program involves at least one of the components considered important here; and (d) explicit, lessons are explicit in terms of the component skill that is their goal. For the most positive, long-lasting results, infusing emotional competence throughout all teaching and creating opportunities for skill application throughout the day would be crucial, as well as having all the adults and all the environments, both proximal and distal, in a child's life involved in emotional competence programming. These goals require school-wide coordination, and ultimately school-family and school-community partnerships (Payton et al., 2000; see Denham & Bassett, 2018, for more details).

Exemplary programs are mentioned by both Denham and Bassett (2018) and Camras and Halberstadt (2017). But two other types of programming bear mentioning here. First, there are several efficacious programs for parents as socializers of emotion. In Havighurst, Wilson, Harley, Prior, and Kehoe (2010), parents participating in the intervention reported significant improvements in their own emotion awareness and regulation, increases in emotion coaching, decreases in emotionally dismissive beliefs and behaviors, and increases in emotion talk; all these aspects of socialization of emotion have been shown to be very important here. Consequently, child emotional knowledge improved, and reductions in child behavior problems were reported. Subsequent programming has been extended to parents of adolescents (Kehoe, Havighurst, & Harley, 2014), parents of toddlers (Lauw, Havighurst, Wilson, Harley, & Northam, 2014), and fathers (Wilson, Havighurst, & Harley, 2014).

Second, several researchers have noted that even toddlers, as well as preschoolers and early gradeschoolers, can benefit from very simple programming aimed at teaching them about emotion terms (Grazzani, Ornaghi, Agliati, & Brazzelli, 2016; Ornaghi, Brockmeier, & Grazzani, 2014; Ornaghi, Grazzani, Cherubin, Conte, & Piralli, 2015; see also Fernández-Sánchez et al., 2015). After reading with their teacher books including an enriched emotional lexicon, and then conversing about them, children showed growth in emotion knowledge, and

in some studies prosocial orientation. The simplicity of this programming, and the young age of some children benefitting from it, are of interest.

Given good programming, teachers will want to know where students stand on emotional competencies. This need leads to a discussion on assessment.

Assessment of Emotional Competence

"What's measured gets treasured" – if emotional competence is assessed well, better decisions about how to facilitate children's functioning can be made (Denham, 2006). Emotional competence assessment can highlight specific needs of children and classrooms in terms of programming, and show overall effects of programming (Denham, Ji, & Hamre, 2010; Denham et al., 2009). But any measure must meet certain standards (for details see Denham & Bassett, 2018; Denham et al., 2009; Kendziora, Weissberg, Ji, & Dusenbury, 2011). Finally, there needs to be a good reason *why* children are assessed, and there needs to be a system in place to *use* the resultant information. Useful emotional competence assessment tools can be found in Denham (2015), Denham, Ji, & Hamre (2010), and Humphrey et al. (2011). However, much work needs to be done to make assessments useful to educators and parents. The Collaborative for Academic, Social, and Emotional Learning (CASEL) Assessment Work Group is working toward that goal. Finally, McKown (2017) offers an articulate analysis for the next generation of emotional competence assessment.

Summary and Conclusions

The importance of emotional competence was introduced, and evidence given of how it facilitates both their social competence and school success, often longitudinally. Attention was given to socializers of such emotional competence: parents, friends, and teachers. Finally, within an educational system of practice put forward, programming and assessment can work synergistically to promote these competencies.

What is needed now, given the relative explosion of research into children's and adolescents' emotional competence, within the last 15 years? There are theoretical issues to consider. Conceptualization of emotion regulation and emotional experience still raises questions. The role of culture in demonstration and socialization of emotional competence should be given even more attention, because this is a global society.

There also are empirical and applied issues to consider. Much more consideration of teachers' own emotional competence and their means of socializing young children's emotional competence is sorely needed at this point, along with integrating this knowledge with current approaches to professional development programming, and assessment. Ways to help parents promote their children's emotional competence, and more on the role of their own emotional competence, capitalizing on newer findings on their emotion regulation, are also required. These are challenges for the field that cannot be overlooked.

There also are several methodological issues that bear attention, to answer questions about emotional competence even more convincingly (Hollenstein, Tighe, & Lougheed, 2017; Lewis et al., 2010). More multi-method, observational, and experience sampling studies are needed. Some attention should be given to the means of measuring parent report of children's emotion regulation and reactions to children's emotions; the very predominant parent-reported measures used now are certainly yielding interesting results, but a refreshed look at their item content potentially could be helpful. More brave forays are needed into physiological means of examining emotional competence its socialization; bidirectional effects; time series/sequential effects (especially of the connection between emotion, emotion regulation, and strategy effectiveness); and examination of the dyad or triad as a unit in socialization research. Person-centered analyses should be utilized more to paint pictures of whole children, not collections of variables. These suggestions are sizeable challenges, but the exhaustive review of emotional competence research in this chapter suggests that the researchers of today and tomorrow will meet them head on.

References

Ahn, H., & Stifter, C. (2006). Child care teachers' response to children's emotional expression. *Early Education and Development, 17*, 253–270. https://doi.org/10.1207/s15566935eed1702_3

Ahn, H. J. (2005). Teachers' discussions of emotion in child care centers. *Early Childhood Education Journal, 32*, 237–242. https://doi.org/10.1007/s10643-004-1424-6

Ansary, N. S., McMahon, T. J., & Luthar, S. S. (2017). Trajectories of emotional–behavioral difficulty and academic competence: A 6-year, person-centered, prospective study of affluent suburban adolescents. *Development and Psychopathology, 29*, 215–234. https://doi.org/10.1017/S0954579416000110

Are, F., & Shaffer, A. (2016). Family emotion expressiveness mediates the relations between maternal emotion regulation and child emotion regulation. *Child Psychiatry & Human Development, 47*, 708–715. https://doi.org/10.1007/s10578-015-0605-4

Alonso-Alberca, N., Vergara, A. I., Fernández-Berrocal, P., Johnson, S. R., & Izard, C. E. (2012). The adaptation and validation of the emotion matching task for preschool children in Spain. *International Journal of Behavioral Development, 36*, 489–494. https://doi.org/10.1177/0165025412462154

Bailey, C. S., Denham, S. A., & Curby, T. W. (2013). Questioning as a component of scaffolding in predicting emotion knowledge in preschoolers. *Early Child Development and Care, 183*(2), 265–279. https://doi.org/10.1080/03004430.2012.671815

Bassett, H. H., Denham, S., Mincic, M., & Graling, K. (2012). The structure of preschoolers' emotion knowledge: Model equivalence and validity using a structural equation modeling approach. *Early Education & Development, 23*, 259–279. https://doi.org/10.1080/10409289.2012.630825

Bassett, H. H., Denham, S. A., Fettig, N. B., Curby, T. W., Mohtasham, M., & Austin, N. (2017). Temperament in the classroom: Children low in surgency are more sensitive to teachers' reactions to emotions. *International Journal of Behavioral Development, 41*, 4–14. https://doi.org/10.1177/0165025416644077

Bassett, H. H., Denham, S. A., Mohtasham, M., & Austin, N. (2016). *Teachers' book-reading styles and development of preschoolers' emotion knowledge: Validation of Book Readings for an Affective Classroom Education (BRACE) coding system*. Fairfax, VA: George Mason University.

Beck, L., Kumschick, I. R., Eid, M., & Klann-Delius, G. (2012). Relationship between language competence and emotional competence in middle childhood. *Emotion, 12*, 503–514. https://doi.org/10.1037/a0026320

Berlin, L. J., & Cassidy, J. (2003). Mothers' self-reported control of their preschool children's emotional expressiveness: A longitudinal study of associations with infant–mother attachment and children's emotion regulation. *Social Development, 12*, 478–495. https://doi.org/10.1111/1467-9507.00244

Bierman, K. L., Nix, R. L., Greenberg, M. T., Blair, C., & Domitrovich, C. E. (2008). Executive functions and school readiness intervention: Impact, moderation, and mediation in the Head Start REDI program. *Development and Psychopathology, 20*, 821–843. https://doi.org/10.1017/S0954579408000394

Blair, B. L., Perry, N. B., O'Brien, M., Calkins, S. D., Keane, S. P., & Shanahan, L. (2014). The indirect effects of maternal emotion socialization on friendship quality in middle childhood. *Developmental Psychology, 50*, 566–576. https://doi.org/10.1037/a0033532

Blair, B. L., Perry, N. B., O'Brien, M., Calkins, S. D., Keane, S. P., & Shanahan, L. (2015). Identifying developmental cascades among differentiated dimensions of social competence and emotion regulation. *Developmental Psychology, 51*, 1062–1073. https://doi.org/10.1037/a0039472

Blankson, A. N., Weaver, J. M., Leerkes, E. M., O'Brien, M., Calkins, S. D., & Marcovitch, S. (2017). Cognitive and emotional processes as predictors of a successful transition into school. *Early Education and Development, 28*, 1–20. https://doi.org/10.1080/10409289.2016.1183434

Booker, J. A., & Dunsmore, J. C. (2017). Affective social competence in adolescence: Current findings and future directions. *Social Development, 26*, 3–20. https://doi.org/10.1111/sode.12193

Brackett, M. A., & Katulak, N. A. (2006). Emotional intelligence in the classroom: Skill-based training for teachers and students. In J. Ciarrochi & J. D. Mayer (Eds.), *Improving emotional intelligence: A practitioner's guide* (pp. 1–27). New York, NY: Psychology Press/Taylor & Francis.

Brajsa-Zganec, A. (2014). Emotional life of the family: Parental meta-emotions, children's temperament and internalising and externalising problems. *Drustvena Istrazivanja, 23*(1), 25–45. https://doi.org/10.5559/di.23.1.02

Breaux, R. P., McQuade, J. D., Harvey, E. A., & Zakarian, R. J. (2018). Longitudinal associations of parental emotion socialization and children's emotion regulation: The moderating role of ADHD symptomatology. *Journal of Abnormal Child Psychology, 46*(4), 671–683.

Bridgeland, J., Bruce, M., & Hariharan, A. (2013). *The missing piece: A national teacher survey on how social and emotional learning can empower children and transform schools.* A Report for CASEL, Civic Enterprises.

Brophy-Herb, H. E., Zajicek-Farber, M. L., Bocknek, E. L., McKelvey, L. M., & Stansbury, K. (2013). Longitudinal connections of maternal supportiveness and early emotion regulation to children's school readiness in low-income families. *Journal of the Society for Social Work and Research, 4*(1), 2–19. https://doi.org/10.5243/jsswr.2013.1

Brown, J. R., & Dunn, J. (1992). Talk with your mother or your sibling? Developmental changes in early family conversations about feelings. *Child Development, 63*, 336–349. https://doi.org/10.2307/1131483

Brownell, C. A., Svetlova, M., Anderson, R., Nichols, S. R., & Drummond, J. (2013). Socialization of early prosocial behavior: Parents' talk about emotions is associated with sharing and helping in toddlers. *Infancy, 18*, 91–119. https://doi.org/10.1111/j.1532-7078.2012.00125.x

Brumariu, L. E., & Kerns, K. A. (2013). Pathways to anxiety: Contributions of attachment history, temperament, peer competence, and ability to manage intense emotions. *Child Psychiatry & Human Development, 44*, 504–515. https://doi.org/10.1007/s10578-012-0345-7

Brumariu, L. E., & Kerns, K. A. (2015). Mother–child emotion communication and childhood anxiety symptoms. *Cognition and Emotion, 29*, 416–431. https://doi.org/10.1080/02699931.2014.917070

Buckholdt, K. E., Parra, G. R., & Jobe-Shields, L. (2014). Intergenerational transmission of emotion dysregulation through parental invalidation of emotions: Implications for adolescent internalizing and externalizing behaviors. *Journal of Child and Family Studies, 23*, 324–332. https://doi.org/10.1007/s10826-013-9768-4

Buettner, C. K., Hur, E. H., Jeon, L., & Andrews, D. W. (2016). What are we teaching the teachers? Child development curricula in US higher education. *Child & Youth Care Forum, 45*, 155–175. https://doi.org/10.1007/s10566-015-9323-0

Calkins, S. D., & Mackler, J. S. (2011). Temperament, emotion regulation, and social development. In M. K. Underwood & L. H. Rosen (Eds.), *Social development: Relationships in infancy, childhood, and adolescence* (pp. 44–70). New York, NY: Guilford Press.

Camodeca, M., & Coppola, G. (2016). Bullying, empathic concern, and internalization of rules among preschool children: The role of emotion understanding. *International Journal of Behavioral Development, 40*, 459–465. https://doi.org/10.1177/0165025415607086

Camras, L. A., & Halberstadt, A. G. (2017). Emotional development through the lens of affective social competence. *Current Opinion in Psychology, 17*, 113–117. https://doi.org/10.1016/j.copsyc.2017.07.003

Carlson, S. M., & Wang, T. (2007). Inhibitory control and emotion regulation in preschool children. *Cognitive Development, 22*, 489–510. https://doi.org/10.1016/j.cogdev.2007.08.002

Carthy, T., Horesh, N., Apter, A., Edge, M. D., & Gross, J. J. (2010). Emotional reactivity and cognitive regulation in anxious children. *Behaviour Research and Therapy, 48*, 384–393. https://doi.org/10.1016/j.brat.2009.12.013

Cassidy, D. J., King, E. K., Wang, Y. C., Lower, J. K., & Kintner-Duffy, V. L. (2017). Teacher work environments are toddler learning environments: Teacher professional well-being, classroom emotional support, and toddlers' emotional expressions and behaviours. *Early Child Development and Care, 187*, 1666–1678. https://doi.org/10.1080/03004430.2016.1180516

Castro, V. L., Cooke, A. N., Halberstadt, A. G., & Garrett-Peters, P. (2018). Bidirectional linkages between emotion recognition and problem behaviors in elementary school children. *Journal of Nonverbal Behavior, 42*, 155–178.

Castro, V. L., Halberstadt, A. G., & Garrett-Peters, P. (2016). A three-factor structure of emotion understanding in third-grade children. *Social Development, 25*, 602–622. https://doi.org/10.1111/sode.12162

Castro, V. L., Halberstadt, A. G., & Garrett-Peters, P. T. (2017). Changing tides: Mothers' supportive emotion socialization relates negatively to third-grade children's social adjustment in school. *Social Development*. https://doi.org/10.1111/sode.12251

Chang, H., Shelleby, E. C., Cheong, J., & Shaw, D. S. (2012). Cumulative risk, negative emotionality, and emotion regulation as predictors of social competence in transition to school: A mediated moderation model. *Social Development, 21*, 780–800. https://doi.org/10.1111/j.1467-9507.2011.00648.x

Cho, H. J., & Lee, D.-g. (2015). The mediating effect of mothers' emotional expressiveness in the relationship between their beliefs about children's emotion and the children's emotional regulation as it is perceived by their mothers. *Korean Journal of Child Studies, 36*(3), 1–18. https://doi.org/10.5723/KJCS.2015.36.3.1

Chronaki, G., Garner, M., Hadwin, J. A., Thompson, M. J., Chin, C. Y., & Sonuga-Barke, E. J. (2015). Emotion-recognition abilities and behavior problem dimensions in preschoolers: Evidence for a specific role for childhood hyperactivity. *Child Neuropsychology, 21*(1), 25–40. https://doi.org/10.1080/09297049.2013.863273

Cohen, J. S., & Mendez, J. L. (2009). Emotion regulation, language ability, and the stability of preschool children's peer play behavior. *Early Education and Development, 20*, 1016–1037. https://doi.org/10.1080/10409280903305716

Cole, P. M. (2014). Moving ahead in the study of the development of emotion regulation. *International Journal of Behavioral Development, 38*, 203–207. https://doi.org/10.1177/0165025414522170

Cole, P. M., Bendezú, J. J., Ram, N., & Chow, S. M. (2017). Dynamical systems modeling of early childhood self-regulation. *Emotion, 17*, 684–699. https://doi.org/10.1037/emo0000268

Cole, P. M., LeDonne, E. N., & Tan, P. Z. (2013). A longitudinal examination of maternal emotions in relation to young children's developing self-regulation. *Parenting, 13*, 113–132. https://doi.org/10.1080/15295192.2012.709152

Cole, P. M., Martin, S. E., & Dennis, T. (2004). Emotion regulation as a scientific construct: Methodological challenges and directions for child development research. *Child Development, 75*, 317–333. https://doi.org/10.1111/j.1467-8624.2004.00673.x

Cole, P. M., & Tan, P. Z. (2007). Emotion socialization from a cultural perspective. In J. E. Grusec & P. D. Hastings (Eds.), *Handbook of socialization: Theory and research* (pp. 516–542). New York, NY: Guilford Press.

Collaborative for Academic and Social-Emotional Learning. (2018a). *Federal policy.* http://www.casel.org/federal-policy-and-legislation/. Accessed 24 Feb. 2018.

Collaborative for Academic and Social-Emotional Learning. (2018b). *State scan scorecard project*. https://casel.org/state-scan-scorecard-project/. Accessed 24 Feb. 2018.

Contreras, J. M., Kerns, K. A., Weimer, B. L., Gentzler, A. L., & Tomich, P. L. (2000). Emotion regulation as a mediator of associations between mother-child attachment and peer relationships in middle childhood. *Journal of Family Psychology, 14*, 111–124. https://doi.org/10.1037/0893-3200.14.1.111

Cook, E. C., Buehler, C., & Blair, B. L. (2013). Adolescents' emotional reactivity across relationship contexts. *Developmental Psychology, 49*, 341–352. https://doi.org/10.1037/a0028342

Costa, A., & Faria, L. (2015). The impact of emotional intelligence on academic achievement: A longitudinal study in Portuguese secondary school. *Learning and Individual Differences, 37*, 38–47. https://doi.org/10.1016/j.lindif.2014.11.011

Crespo, L. M., Trentacosta, C. J., Aikins, D., & Wargo-Aikins, J. (2017). Maternal emotion regulation and children's behavior problems: The mediating role of child emotion regulation. *Journal of Child and Family Studies, 26*, 2797-2809. https://doi.org/10.1007/s10826-017-0791-8

Curby, T. W., Brock, L. L., & Hamre, B. K. (2013). Teachers' emotional support consistency predicts children's achievement gains and social skills. *Early Education & Development, 24*, 292–309. https://doi.org/10.1080/10409289.2012.665760

Curby, T. W., Brown, C. A., Bassett, H. H., & Denham, S. A. (2015). Associations between preschoolers' social-emotional competence and preliteracy skills. *Infant and Child Development, 24*, 549–570. https://doi.org/10.1002/icd.1899

Çorapçı, F., Friedlmeier, W., Benga, O., Strauss, C., Pitica, I., & Susa, G. (2018). Cultural socialization of toddlers in emotionally charged situations. *Social Development, 27*(2), 262–278. Online only.

Davis, M., & Suveg, C. (2014). Focusing on the positive: A review of the role of child positive affect in developmental psychopathology. *Clinical Child and Family Psychology Review, 17*(2), 97–124. https://doi.org/10.1007/s10567-013-0162-y

Davis, M., Suveg, C., & Shaffer, A. (2015a). Maternal positive affect mediates the link between family risk and preschoolers' positive affect. *Child Psychiatry & Human Development, 46*, 167–175. https://doi.org/10.1007/s10578-014-0516-9

Davis, M., Suveg, C., & Shaffer, A. (2015b). The value of a smile: Child positive affect moderates relations between maternal emotion dysregulation and child adjustment problems. *Journal of Child and Family Studies, 24*, 2441-2452. https://doi.org/10.1007/s10826-014-0047-9

De Leersnyder, J., Boiger, M., & Mesquita, B. (2015). Cultural differences in emotions. In *Emerging Trends in the Social and Behavioral Sciences: An Interdisciplinary, Searchable, and Linkable Resource* (pp. 1–15). Hoboken, NJ: Wiley.

Deneault, J. & Ricard, M. (2013). Are emotion and mind understanding differently linked to young children's social adjustment? Relationships between behavioral consequences of emotions, false belief, and SCBE. *The Journal of Genetic Psychology, 174*, 88–116. https://doi.org/10.1080/00221325.2011.642028

Denham, S. A. (1998). *Emotional development in young children*. New York, NY: Guilford Press.

Denham, S. A. (2006). Social-emotional competence as support for school readiness: What is it and how do we assess it? *Early Education and Development, 17*, 57–89. https://doi.org/10.1207/s15566935eed1701_4

Denham, S. A. (2015). Assessment of social-emotional learning in educational contexts. In J. Durlak, C. E. Domitrovich, R. W. Weissberg, & T. P. Gullotta (Eds.), *The handbook of social and emotional learning* (pp. 285–300). New York, NY: Guilford Press.

Denham, S. A., & Bassett, H. H. (2018). Implications of preschooler's emotional competence in the classroom. In K. Keefer, J. D. A. Saklofske, & D. H. Parker (Eds.) *The handbook of emotional intelligence in education* (pp. 135–172). New York: Springer.

Denham, S. A., Cook, M., Zoller, D. (1992). Baby looks very sad": Implications of conversations about feelings between mother and preschooler. *British Journal of Developmental Psychology, 10*, 301–315.

Denham, S. A., Bassett, H. H., & Miller, S. (2017). Early childhood teachers' socialization of emotion: Contextual and individual contributors. *Child & Youth Care Forum, 46*, 805–824. https://doi.org/10.1007/s10566-017-9409-y

Denham, S. A., Bassett, H. H., Mincic, M. M., Kalb, S. C., Way, E., Wyatt, T., & Segal, Y. (2012). Social-emotional learning profiles of preschoolers' early school success: A person-centered approach. *Learning and Individual Differences, 22*, 178–189. https://doi.org/10.1016/j.lindif.2011.05.001

Denham, S. A., Bassett, H. H., Silva, R., Mortari, L., Plourde, S., Herndon, K., & Zinsser, K. (2016, July). *Preschool teachers' emotion socialization and child social-emotional behavior in two countries.* Poster presentation at the 24th Biennial Meeting of the International Society for the Study of Behavioral Development, Vilnius, Lithuania.

Denham, S. A., Bassett, H. H., Sirotkin, Y., & Zinsser, K. (2013). Head Start preschoolers' emotional positivity and emotion regulation predict their social-emotion behavior, classroom adjustment, and early school success. *National Head Start Association Dialog, 16*(2), 8–33. Online only.

Denham, S. A., Bassett, H. H., Thayer, S. K., Mincic, M., Sirotkin, Y. S., & Zinsser, K. (2012). Observing preschoolers' social-emotional behavior: Structure, foundations, and prediction of early school success. *Journal of Genetic Psychology, 173*, 246–278. https://doi.org/10.1080/00221325.2011.597457

Denham, S. A., Bassett, H. H., & Wyatt, T. (2014). The socialization of emotional competence. In J. E. Grusec & P. D. Hastings (Eds.), *Handbook of socializa-*

tion: Theory and research (2nd ed., pp. 590–613). New York, NY: Guilford Publications.

Denham, S. A., Bassett, H. H., & Zinsser, K. (2012). Early childhood teachers as socializers of young children's emotional competence. *Early Childhood Education Journal, 40*, 137–143. https://doi.org/10.1007/s10643-012-0504-2

Denham, S. A., Bassett, H. H., Zinsser, K., & Wyatt, T. M. (2014). How preschoolers' social–emotional learning predicts their early school success: Developing theory-promoting, competency-based assessments. *Infant and Child Development, 23*, 426–454. https://doi.org/10.1002/icd.1840

Denham, S. A., Blair, K., Schmidt, M., & DeMulder, E. (2002). Compromised emotional competence: Seeds of violence sown early? *American Journal of Orthopsychiatry, 72*, 70–82. https://doi.org/10.1037/0002-9432.72.1.70

Denham, S. A., Blair, K. A., DeMulder, E., Levitas, J., Sawyer, K. S., Auerbach-Major, S. T., & Queenan, P. (2003). Preschoolers' emotional competence: Pathway to social competence? *Child Development, 74*, 238–256. https://doi.org/10.1111/1467-8624.00533

Denham, S. A., Brown, C. A., & Domitrovich, C. E. (2010). "Plays nice with others": Social-emotional learning and academic success. *Early Education and Development, 21*, 652–680. https://doi.org/10.1080/10409289.2010.497450

Denham, S. A., Grant, S., & Hamada, H. A. (2002). *I have two first teachers about emotions: Contributions of mothers and teachers in promoting preschoolers' self-regulation and social competence*. Poster presented at the National Head Start Research Conference, Washington, DC.

Denham, S. A., & Grout, L. (1992). Mothers' emotional expressiveness and coping: Topography and relations with preschoolers' social-emotional competence. *Genetic, Social, and General Psychology Monographs, 118*, 75–101.

Denham, S. A., Ji, P., & Hamre, B. (2010). *Compendium of social-emotional learning and associated assessment measures*. Chicago, IL: Collaborative for Academic, Social, and Emotional Learning.

Denham, S. A., & Kochanoff, A. T. (2002). Parental contributions to preschoolers' understanding of emotion. *Marriage & Family Review, 34*, 311–343. https://doi.org/10.1300/J002v34n03_06

Denham, S. A., McKinley, M., Couchoud, E. A., & Holt, R. (1990). Emotional and behavioral predictors of peer status in young preschoolers. *Child Development, 61*, 1145–1152. https://doi.org/10.2307/1130882

Denham, S. A., Renwick-DeBardi, S., & Hewes, S. (1994). Affective communication between mothers and preschoolers: Relations with social-emotional competence. *Merrill-Palmer Quarterly, 40*, 488–508.

Denham, S. A., Warren, H. K., von Salisch, M., Benga, O., Chin, J.-C., & Geangu, E. (2011). Emotions and peer relationships. In C. Hart & P. K. Smith (Eds.), *Wiley-Blackwell handbook of childhood social development* (2nd ed., pp. 413–433). New York, NY: Blackwell Publishers. https://doi.org/10.1002/9781444390933.ch22

Denham, S. A., Wyatt, T. M., Bassett, H. H., Echeverria, D., & Knox, S. S. (2009). Assessing social-emotional development in children from a longitudinal perspective. *Journal of Epidemiology and Community Health, 63*, i37–i52. https://doi.org/10.1136/jech.2007.070797

Denham, S. A., Zoller, D., & Couchoud, E. A. (1994). Socialization of preschoolers' emotion understanding. *Developmental Psychology, 30*, 928–936. https://doi.org/10.1037/0012-1649.30.6.928

Desjardins, T. L., & Leadbeater, B. J. (2011). Relational victimization and depressive symptoms in adolescence: Moderating effects of mother, father, and peer emotional support. *Journal of Youth and Adolescence, 40*, 531–544. https://doi.org/10.1007/s10964-010-9562-1

Di Maggio, R., Zappulla, C., & Pace, U. (2016). The relationship between emotion knowledge, emotion regulation and adjustment in preschoolers: A mediation model. *Journal of Child and Family Studies, 25*, 2626-2635. https://doi.org/10.1007/s10826-016-0409-6

Diaz, A., Eisenberg, N., Valiente, C., VanSchyndel, S., Spinrad, T. L., Berger, R., … Southworth, J. (2017). Relations of positive and negative expressivity and effortful control to kindergarteners' student–teacher relationship, academic engagement, and externalizing problems at school. *Journal of Research in Personality, 67*, 3–14. https://doi.org/10.1016/j.jrp.2015.11.002

Drummond, J., Paul, E. F., Whitney, E. W., Hammond, S. I., & Brownell, C. A. (2014). "Here, there and everywhere:" emotion and mental state talk in different social contexts predicts empathic helping in toddlers. *Frontiers in Psychology, 5*, 361. https://doi.org/10.3389/fpsyg.2014.00361

Duncombe, M., Havighurst, S. S., Holland, K. A., & Frankling, E. J. (2013). Relations of emotional competence and effortful control to child disruptive behavior problems. *Early Education & Development, 24*, 599–615. https://doi.org/10.1080/10409289.2012.701536

Duncombe, M. E., Havighurst, S. S., Holland, K. A., & Frankling, E. J. (2012). The contribution of parenting practices and parent emotion factors in children at risk for disruptive behavior disorders. *Child Psychiatry & Human Development, 43*, 715–733. https://doi.org/10.1007/s10578-012-0290-5

Dunn, J. (1994). Understanding others and the social world: Current issues in developmental research and their relation to preschool experiences and practice. *Journal of Applied Developmental Psychology, 15*, 571–583. https://doi.org/10.1016/0193-3973(94)90023-X

Dunn, J., Brown, J. R., Slomkowski, C., Tesla, C., & Youngblade, L. (1991). Young children's understanding of other people's feelings and beliefs: Individual differences and their antecedents. *Child Development, 62*, 1352–1366. https://doi.org/10.2307/1130811

Dunsmore, J. C., Booker, J. A., & Ollendick, T. H. (2013). Parental emotion coaching and child emotion regulation as protective factors for children with oppositional

defiant disorder. *Social Development, 22*, 444–466. https://doi.org/10.1111/j.1467-9507.2011.00652.x

Dunsmore, J. C., Booker, J. A., Ollendick, T. H., & Greene, R. W. (2016). Emotion socialization in the context of risk and psychopathology: Maternal emotion coaching predicts better treatment outcomes for emotionally labile children with oppositional defiant disorder. *Social Development, 25*, 8–26. https://doi.org/10.1111/sode.12109

Dunsmore, J. C., Her, P., Halberstadt, A. G., & Perez-Rivera, M. B. (2009). Parents' beliefs about emotions and children's recognition of parents' emotions. *Journal of Nonverbal Behavior, 33*(2), 121–140. https://doi.org/10.1007/s10919-008-0066-6

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions. *Child Development, 82*, 405–432. https://doi.org/10.1111/j.1467-8624.2010.01564.x

Dusenbury, L., Newman, J. A., Weissberg, R. P., Goren, P., Domitrovich, C. E., Mart, A. K., & Cascarino, J. (2015). Developing a blueprint for preschool through high school education in social and emotional learning: The case for state learning standards. In J. A. Durlak, C. E. Domitrovich, R. P. Weissberg, & T. P. Gullotta (Eds.), *Handbook of social and emotional learning: Research and practice* (pp. 532–548). New York, NY: Guilford.

Eastabrook, J. M., Flynn, J. J., & Hollenstein, T. (2014). Internalizing symptoms in female adolescents: Associations with emotional awareness and emotion regulation. *Journal of Child and Family Studies, 23*, 487–496. https://doi.org/10.1007/s10826-012-9705-y

Eisenberg, N., Cumberland, A., & Spinrad, T. L. (1998). Parental socialization of emotion. *Psychological Inquiry, 9*, 241–273. https://doi.org/10.1207/s15327965pli0904_1

Eisenberg, N., Fabes, R. A., Shepard, S. A., Murphy, B. C., Guthrie, I. K., Jones, S., … Maszk, P. (1997). Contemporaneous and longitudinal prediction of children's social functioning from regulation and emotionality. *Child Development, 68*, 642–664. https://doi.org/10.2307/1132116

Eisenberg, N., Sadovsky, A., & Spinrad, T. L. (2005). Associations of emotion-related regulation with language skills, emotion knowledge, and academic outcomes. *New Directions for Child and Adolescent Development, 109*, 103–118. https://doi.org/10.1002/cd.143

Ersay, E. (2007). *Preschool teachers' emotional experience traits, awareness of their own emotions and their emotional socialization practices*. Retrieved from ProQuest Dissertations and Theses database (AAT 3266106).

Ersay, E. (2015). Preschool teachers' emotional awareness levels and their responses to children's negative emotions. *Procedia-Social and Behavioral Sciences, 191*, 1833–1837. https://doi.org/10.1016/j.sbspro.2015.04.220

Fabes, R. A., Leonard, S. A., Kupanoff, K., & Martin, C. L. (2001). Parental coping with children's negative emotions: Relations with children's emotional and social responding. *Child Development, 72*, 907–920. https://doi.org/10.1111/1467-8624.00323

Fabes, R. A., Poulin, R. E., Eisenberg, N., & Madden-Derdich, D. A. (2002). The Coping with Children's Negative Emotions Scale (CCNES): Psychometric properties and relations with children's emotional competence. *Marriage & Family Review, 34*, 285–310. https://doi.org/10.1300/J002v34n03_05

Fernández-Sánchez, M., Quintanilla, L., & Giménez-Dasí, M. (2015). Thinking emotions with two-year-old children: An educational programme to improve emotional knowledge in young preschoolers. *Cultura y Educación, 27*, 802–838. https://doi.org/10.1080/11356405.2015.1089385

Ferrier, D., Karalus, S. P., Denham, S. A., & Bassett, H. H. (2018). Indirect effects of cognitive self- regulation on the relation between emotion knowledge and emotionality. *Early Child Development and Care, 188*(7), 966–979. https://doi.org/10.1080/03004430.2018.1445730

Fiorilli, C., Stasio, S., Chicchio, C., & Chan, S. M. (2015). Emotion socialization practices in Italian and Hong Kong-Chinese mothers. *Springerplus, 4*(1), 758. https://doi.org/10.1186/s40064-015-1550-1

Friedlmeier, W., Çorapçı, F., & Benga, O. (2015). Early emotional development in cultural perspective. In L. A. Jensen (Ed.), *The Oxford handbook of human development and culture: An interdisciplinary perspective* (pp. 127–148). New York, NY: Oxford University Press.

Friedlmeier, W., Çorapçı, F., & Cole, P. M. (2011). Emotion socialization in cross-cultural perspective. *Social and Personality Psychology Compass, 5*, 410–427. https://doi.org/10.1111/j.1751-9004.2011.00362.x

Frost, A., Hoyt, L. T., Chung, A. L., & Adams, E. K. (2015). Daily life with depressive symptoms: Gender differences in adolescents' everyday emotional experiences. *Journal of Adolescence, 43*, 132–141. https://doi.org/10.1016/j.adolescence.2015.06.001

Fussner, L. M., Luebbe, A. M., & Bell, D. J. (2015). Dynamics of positive emotion regulation: Associations with youth depressive symptoms. *Journal of Abnormal Child Psychology, 43*, 475–488. https://doi.org/10.1007/s10802-014-9916-3

Fields-Olivieri, M. A., Cole, P. M., & Maggi, M. C. (2017). Toddler emotional states, temperamental traits, and their interaction: Associations with mothers' and fathers' parenting. *Journal of Research in Personality, 67*,106–119. https://doi.org/10.1016/j.jrp.2016.05.007

Garner, P. W. (2006). Prediction of prosocial and emotional competence from maternal behavior in African American preschoolers. *Cultural Diversity and Ethnic Minority Psychology, 12*, 179–198. https://doi.org/10.1037/1099-9809.12.2.179

Garner, P. W. (2010). Emotional competence and its influences on teaching and learning. *Educational Psychology Review, 22*, 297–321. https://doi.org/10.1007/s10648-010-9129-4

Garner, P. W., Dunsmore, J. C., & Southam-Gerrow, M. (2008). Mother–child conversations about emotions: Linkages to child aggression and prosocial behavior. *Social Development, 17*, 259–277. https://doi.org/10.1111/j.1467-9507.2007.00424.x

Garner, P. W., Jones, D. C., Gaddy, G., & Rennie, K. (1997). Low income mothers' conversations about emotions and their children's emotional competence. *Social Development, 6*, 37–52. https://doi.org/10.1111/j.1467-9507.1997.tb00093.x

Garner, P. W., Jones, D. C., & Miner, J. L. (1994). Social competence among low-income preschoolers: Emotion socialization practices and social cognitive correlates. *Child Development, 65*, 622–637. https://doi.org/10.2307/1131405

Garner, P. W., & Waajid, B. (2008). The associations of emotion knowledge and teacher-child relationships to preschool children's school-related developmental competence. *Journal of Applied Developmental Psychology, 29*, 89–100. https://doi.org/10.1016/j.appdev.2007.12.001

Garner, P. W., & Waajid, B. (2012). Emotion knowledge and self-regulation as predictors of preschoolers' cognitive ability, classroom behavior, and social competence. *Journal of Psychoeducational Assessment, 30*, 330–343. https://doi.org/10.1177/0734282912449441

Garrett-Peters, P. T., Castro, V. L., & Halberstadt, A. G. (2017). Parents' beliefs about children's emotions, children's emotion understanding, and classroom adjustment in middle childhood. *Social Development, 26*, 575–590. https://doi.org/10.1111/sode.12222

Gartstein, M. A., Putnam, S. P., & Kliewer, R. (2016). Do infant temperament characteristics predict core academic abilities in preschool-aged children? *Learning and Individual Differences, 45*, 299–306. https://doi.org/10.1016/j.lindif.2015.12.022

Giesbrecht, G. F., Miller, M. R., & Müller, U. (2010). The anger–distress model of temper tantrums: Associations with emotional reactivity and emotional competence. *Infant and Child Development, 19*, 478–497. https://doi.org/10.1002/icd.677

Giletta, M., Scholte, R. H., Burk, W. J., Engels, R. C., Larsen, J. K., Prinstein, M. J., & Ciairano, S. (2011). Similarity in depressive symptoms in adolescents' friendship dyads: Selection or socialization? *Developmental Psychology, 47*, 1804–1814. https://doi.org/10.1037/a0023872

Glick, G. C., & Rose, A. J. (2011). Prospective associations between friendship adjustment and social strategies: Friendship as a context for building social skills. *Developmental Psychology, 47*, 1117–1132. https://doi.org/10.1037/a0023277

Graziano, P. A., Reavis, R. D., Keane, S. P., & Calkins, S. D. (2007). The role of emotion regulation in children's early academic success. *Journal of School Psychology, 45*, 3–19. https://doi.org/10.1016/j.jsp.2006.09.002

Grazzani, I., Ornaghi, V., Agliati, A., & Brazzelli, E. (2016). How to foster toddlers' mental-state talk, emotion understanding, and prosocial behavior: A conversation-based intervention at nursery school. *Infancy, 21*, 199–227. https://doi.org/10.1111/infa.12107

Gündüz, G., Yagmurlu, B., & Harma, M. (2015). Self-regulation mediates the link between family context and socioemotional competence in Turkish preschoolers. *Early Education and Development, 26*(5–6), 729–748. https://doi.org/10.1080/10409289.2015.985148

Gunzenhauser, C., Fäsche, A., Friedlmeier, W., & von Suchodoletz, A. (2014). Face it or hide it: Parental socialization of reappraisal and response suppression. *Frontiers in Psychology, 4*, 992. https://doi.org/10.3389/fpsyg.2013.00992

Halberstadt, A., Denham, S. A., & Dunsmore, J. (2001). Affective social competence. *Social Development, 10*, 79–119. https://doi.org/10.1111/1467-9507.00150

Halberstadt, A. G., Dunsmore, J. C., Bryant, A., Jr., Parker, A. E., Beale, K. S., & Thompson, J. A. (2013). Development and validation of the Parents' Beliefs About Children's Emotions Questionnaire. *Psychological Assessment, 25*, 1195–1210. https://doi.org/10.1037/a0033695

Halberstadt, A. G., Thompson, J. A., Parker, A. E., & Dunsmore, J. C. (2008). Parents' emotion-related beliefs and behaviours in relation to children's coping with the 11 September 2001 terrorist attacks. *Infant and Child Development, 17*, 557–580. https://doi.org/10.1002/icd.569

Han, Z. R., Qian, J., Gao, M., & Dong, J. (2015). Emotion socialization mechanisms linking Chinese fathers', mothers', and children's emotion regulation: A moderated mediation model. *Journal of Child and Family Studies, 24*, 3570-3579. https://doi.org/10.1007/s10826-015-0158-y

Hastings, P. D., Klimes-Dougan, B., Kendziora, K. T., Brand, A., & Zahn-Waxler, C. (2014). Regulating sadness and fear from outside and within: Mothers' emotion socialization and adolescents' parasympathetic regulation predict the development of internalizing difficulties. *Development and Psychopathology, 26*(4pt2), 1369–1384. https://doi.org/10.1017/S0954579414001084

Hastings, P. D., Sullivan, C., McShane, K. E., Coplan, R. J., Utendale, W. T., & Vyncke, J. D. (2008). Parental socialization, vagal regulation, and preschoolers' anxious difficulties: Direct mothers and moderated fathers. *Child Development, 79*, 45–64. https://doi.org/10.1111/j.1467-8624.2007.01110.x

Havighurst, S. S., Wilson, K. R., Harley, A. E., Prior, M. R., & Kehoe, C. (2010). Tuning in to kids: Improving emotion socialization practices in parents of preschool children–findings from a community trial. *Journal of Child Psychology and Psychiatry, 51*, 1342–1350. https://doi.org/10.1111/j.1469-7610.2010.02303.x

Heinze, J. E., Miller, A. L., Seifer, R., Dickstein, S., & Locke, R. L. (2015). Emotion knowledge, loneliness, negative social experiences, and internalizing symptoms among low-income preschoolers. *Social Development, 24*, 240–265. https://doi.org/10.1111/sode.12083

Hernández, M. M., Eisenberg, N., Valiente, C., Diaz, A., VanSchyndel, S. K., Berger, R. H., … Southworth, J. (2017). Concurrent and longitudinal associations of peers' acceptance with emotion and effortful control in kindergarten. *International Journal of Behavioral Development, 41*, 30–40. https://doi.org/10.1177/0165025415608519

Hernández, M. M., Eisenberg, N., Valiente, C., Spinrad, T. L., VanSchyndel, S. K., Diaz, A., … Southworth, J. (2017). Observed emotions as predictors of quality of kindergartners' social relationships. *Social Development, 26*, 21–39. https://doi.org/10.1111/sode.12179

Hernández, M. M., Eisenberg, N., Valiente, C., VanSchyndel, S. K., Spinrad, T. L., Silva, K. M., … Southworth, J. (2016). Emotional expression in school context, social relationships, and academic adjustment in kindergarten. *Emotion, 16*, 553–566. https://doi.org/10.1037/emo0000147

Herndon, K. J., Bailey, C. S., Shewark, E. A., Denham, S. A., & Bassett, H. H. (2013). Preschoolers' emotion expression and regulation: Relations with school adjustment. *The Journal of Genetic Psychology, 174*, 642–663. https://doi.org/10.1080/00221325.2012.759525

Hessler, D. M., & Katz, L. F. (2010). Brief report: Associations between emotional competence and adolescent risky behavior. *Journal of Adolescence, 33*, 241–246. https://doi.org/10.1016/j.adolescence.2009.04.007

Hollenstein, T., Tighe, A. B., & Lougheed, J. P. (2017). Emotional development in the context of mother–child relationships. *Current Opinion in Psychology, 17*, 140–144. https://doi.org/10.1016/j.copsyc.2017.07.010

Holodynski, M., Seeger, D., Kortas-Hartmann, P., & Wörmann, V. (2013). Placing emotion regulation in a developmental framework of self-regulation. In N. Fox, G. A. Morgan, D. J. Fidler, L. A. Daunhauer, & K. C. Barrett (Eds.), *Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 27–59). New York, NY: Psychology Press. https://doi.org/10.4324/9780203080719.ch3

Hudson, A., & Jacques, S. (2014). Put on a happy face! Inhibitory control and socioemotional knowledge predict emotion regulation in 5-to 7-year-olds. *Journal of Experimental Child Psychology, 123*, 36–52. https://doi.org/10.1016/j.jecp.2014.01.012

Humphrey, N. (2013). *Social and emotional learning: A critical appraisal*. London, UK: Sage. https://doi.org/10.4135/9781446288603

Humphrey, N., Kalambouka, A., Wigelsworth, M., Lendrum, A., Deighton, J., & Wolpert, M. (2011). Measures of social and emotional skills for children and young people: A systematic review. *Educational and Psychological Measurement, 71*, 617–637. https://doi.org/10.1177/0013164410382896

Hurrell, K. E., Houwing, F. L., & Hudson, J. L. (2017). Parental meta-emotion philosophy and emotion coaching in families of children and adolescents with an anxiety disorder. *Journal of Abnormal Child Psychology, 45*, 569–582. https://doi.org/10.1007/s10802-016-0180-6

Hurrell, K. E., Hudson, J. L., & Schniering, C. A. (2015). Parental reactions to children's negative emotions: Relationships with emotion regulation in children with an anxiety disorder. *Journal of Anxiety Disorders, 29*, 72–82. https://doi.org/10.1016/j.janxdis.2014.10.008

Ivcevic, Z., & Brackett, M. (2014). Predicting school success: Comparing conscientiousness, grit, and emotion regulation ability. *Journal of Research in Personality, 52*, 29–36. https://doi.org/10.1016/j.jrp.2014.06.005

Izard, C., Fine, S., Schultz, D., Mostow, A., Ackerman, B., & Youngstrom, E. (2001). Emotion knowledge as a predictor of social behavior and academic competence in children at risk. *Psychological Science, 12*, 18–23. https://doi.org/10.1111/1467-9280.00304

Izard, C. E. (2002). Translating emotion theory and research into preventive interventions. *Psychological Bulletin, 128*, 796–824. https://doi.org/10.1037/0033-2909.128.5.796

Jennings, P. A., & Greenberg, M. T. (2009). The prosocial classroom: Teacher social and emotional competence in relation to student and classroom outcomes. *Review of Educational Research, 79*, 491–525. https://doi.org/10.3102/0034654308325693

Jeon, L., Hur, E., & Buettner, C. K. (2016). Child-care chaos and teachers' responsiveness: The indirect associations through teachers' emotion regulation and coping. *Journal of School Psychology, 59*, 83–96. https://doi.org/10.1016/j.jsp.2016.09.006

Jin, Z., Zhang, X., & Han, Z. R. (2017). Parental emotion socialization and child psychological adjustment among Chinese urban families: Mediation through child emotion regulation and moderation through dyadic collaboration. *Frontiers in Psychology, 8*, 2198. https://doi.org/10.3389/fpsyg.2017.02198

Jobe-Shields, L., Buckholdt, K. E., Parra, G. R., & Tillery, R. N. (2014). Adolescent reactions to maternal responsiveness and internalizing symptomatology: A daily diary investigation. *Personal Relationships, 21*, 335–348. https://doi.org/10.1111/pere.12034

Jones, D. E., Greenberg, M., & Crowley, M. (2015). Early social-emotional functioning and public health: The relationship between kindergarten social competence and future wellness. *American Journal of Public Health, 105*, 2283-2290. https://doi.org/10.2105/AJPH.2015.302630

Kam, C. M., Greenberg, M. T., Bierman, K. L., Coie, J. D., Dodge, K. A., Foster, M. E., … Conduct Problems Prevention Research Group. (2011). Maternal depressive symptoms and child social preference during the early school years: Mediation by maternal warmth and child emotion regulation. *Journal of Abnormal Child Psychology, 39*, 365–377. https://doi.org/10.1007/s10802-010-9468-0

Karalus, S. P., Herndon, K., Bassett, H. H., & Denham, S. A. (2016). *Childcare teachers' socialization practices and beliefs on children's social emotional com-*

petence and the moderating contribution of classroom age. Unpublished manuscript. Fairfax, VA: George Mason University.

Kehoe, C. E., Havighurst, S. S., & Harley, A. E. (2014). Tuning in to teens: Improving parent emotion socialization to reduce youth internalizing difficulties. *Social Development, 23*, 413–431. https://doi.org/10.1111/sode.12060

Kemeny, M. E., Foltz, C., Cavanagh, J. F., Cullen, M., Giese-Davis, J., Jennings, P., … Ekman, P. (2012). Contemplative/emotion training reduces negative emotional behavior and promotes prosocial responses. *Emotion, 12*, 338–350. https://doi.org/10.1037/a0026118

Kendziora, K., Weissberg, R. P., Ji, P., & Dusenbury, L. A. (2011). *Strategies for social and emotional learning: Preschool and elementary grade student learning standards and assessment*. Newton, MA: National Center for Mental Health Promotion and Youth Violence Prevention, Education Development Center, Inc..

Kiliç, S. (2015). Emotional competence and emotion socialization in preschoolers: The viewpoint of preschool teachers. *Educational Sciences: Theory and Practice, 15*, 1007–1020. https://doi.org/10.12738/estp.2015.4.2529

Kim, G., Walden, T., Harris, V., Karrass, J., & Catron, T. (2007). Positive emotion, negative emotion, and emotion control in the externalizing problems of school-aged children. *Child Psychiatry and Human Development, 37*, 221–239. https://doi.org/10.1007/s10578-006-0031-8

King, E. K., Johnson, A. V., Cassidy, D. J., Wang, Y. C., Lower, J. K., & Kintner-Duffy, V. L. (2016). Preschool teachers' financial well-being and work time supports: Associations with children's emotional expressions and behaviors in classrooms. *Early Childhood Education Journal, 44*, 545–553. https://doi.org/10.1007/s10643-015-0744-z

Kiuru, N., Burk, W. J., Laursen, B., Nurmi, J. E., & Salmela-Aro, K. (2012). Is depression contagious? A test of alternative peer socialization mechanisms of depressive symptoms in adolescent peer networks. *Journal of Adolescent Health, 50*, 250–255. https://doi.org/10.1016/j.jadohealth.2011.06.013

Klein, M. R., Moran, L., Cortes, R., Zalewski, M., Ruberry, E. J., & Lengua, L. J. (2018). Temperament, mothers' reactions to children's emotional experiences, and emotion understanding predicting adjustment in preschool children. *Social Development, 27*(2), 351–365. https://doi.org/10.1111/sode.12282

Klimes-Dougan, B., Brand, A. E., Zahn-Waxler, C., Usher, B., Hastings, P. D., Kendziora, K., & Garside, R. B. (2007). Parental emotion socialization in adolescence: Differences in sex, age and problem status. *Social Development, 16*, 326–342. https://doi.org/10.1111/j.1467-9507.2007.00387.x

Klimes-Dougan, B., Pearson, T. E., Jappe, L., Mathieson, L., Simard, M. R., Hastings, P., & Zahn-Waxler, C. (2014). Adolescent emotion socialization: A longitudinal study of friends' responses to negative emotions. *Social Development, 23*, 395–412. https://doi.org/10.1111/sode.12045

Kolmodin, K. E. (2007). *Exploring links between children's understanding of emotion, parent-child reminiscing about emotional events, and the kindergarten classroom affective environment*. Dissertation, ProQuest Information & Learning.

Kranzler, A., Young, J. F., Hankin, B. L., Abela, J. R. Z., Elias, M. J., & Selby, E. A. (2016). Emotional awareness: A transdiagnostic predictor of depression and anxiety for children and adolescents. *Journal of Clinical Child & Adolescent Psychology, 45*, 262–269. https://doi.org/10.1080/15374416.2014.987379

Kromm, H., Färber, M., & Holodynski, M. (2015). Felt or false smiles? Volitional regulation of emotional expression in 4-, 6-, and 8-year-old children. *Child Development, 86*, 579–597. https://doi.org/10.1111/cdev.12315

Kuhnert, R. L., Begeer, S., Fink, E., & de Rosnay, M. (2017). Gender-differentiated effects of theory of mind, emotion understanding, and social preference on prosocial behavior development: A longitudinal study. *Journal of Experimental Child Psychology, 154*, 13–27. https://doi.org/10.1016/j.jecp.2016.10.001

Laible, D., Carlo, G., Murphy, T., Augustine, M., & Roesch, S. (2014). Predicting children's prosocial and co-operative behavior from their temperamental profiles: A person-centered approach. *Social Development, 23*, 734–752. https://doi.org/10.1111/sode.12072

Laible, D., Carlo, G., Panfile, T., Eye, J., & Parker, J. (2010). Negative emotionality and emotion regulation: A person-centered approach to predicting socio-emotional adjustment in young adolescents. *Journal of Research in Personality, 44*, 621–629. https://doi.org/10.1016/j.jrp.2010.08.003

Laible, D., Panfile Murphy, T., & Augustine, M. (2013). Constructing emotional and relational understanding: The role of mother–child reminiscing about negatively valenced events. *Social Development, 22*, 300–318. https://doi.org/10.1111/sode.12022

Laible, D. J., Kumru, A., Carlo, G., Streit, C., Selcuk, B., & Sayil, M. (2017). The longitudinal associations among temperament, parenting, and Turkish children's prosocial behaviors. *Child Development, 88*, 1057–1062. https://doi.org/10.1111/cdev.12877

Lambie, J. A., & Lindberg, A. (2016). The role of maternal emotional validation and invalidation on children's emotional awareness. *Merrill-Palmer Quarterly, 62*, 129–157. https://doi.org/10.13110/merrpalmquar1982.62.2.0129

Larson, R. W., Moneta, G., Richards, M. H., & Wilson, S. (2002). Continuity, stability, and change in daily emotional experience across adolescence. *Child Development, 73*, 1151–1165. https://doi.org/10.1111/1467-8624.00464

Larson, R. W., & Richards, M. H. (1994). Family emotions: Do young adolescents and their parents experience the same states? *Journal of Research on Adolescence, 4*, 567–583. https://doi.org/10.1207/s15327795jra0404_8

Lauw, M. S., Havighurst, S. S., Wilson, K. R., Harley, A. E., & Northam, E. A. (2014). Improving parenting of toddlers' emotions using an emotion coaching parenting program: A pilot study of tuning in to toddlers. *Journal of Community Psychology, 42*, 169–175. https://doi.org/10.1002/jcop.21602

Lee, J. H., Eoh, Y., Jeong, A., & Park, S. H. (2017). Preschoolers' emotional understanding and psychosocial adjustment in Korea: The moderating effect of maternal attitude towards emotional expressiveness. *Journal of Child and Family Studies, 26(7)*, 1854–186.

Leerkes, E. M., Paradise, M. J., O'Brien, M., Calkins, S. D., & Lange, G. (2008). Emotion and cognition processes in preschool children. *Merrill-Palmer Quarterly, 54*,102–124. https://doi.org/10.1353/mpq.2008.0009

Legerski, J. P., Biggs, B. K., Greenhoot, A. F., & Sampilo, M. L. (2015). Emotion talk and friend responses among early adolescent same-sex friend dyads. *Social Development, 24*, 20–38. https://doi.org/10.1111/sode.12079

Lewis, A. R., Zinbarg, R. E., & Durbin, C. E. (2010). Advances, problems, and challenges in the study of emotion regulation: A commentary. *Journal of Psychopathology and Behavioral Assessment, 32*, 83–91. https://doi.org/10.1007/s10862-009-9170-0

Liao, Z., Li, Y., & Su, Y. (2014). Emotion understanding and reconciliation in overt and relational conflict scenarios among preschoolers. *International Journal of Behavioral Development, 38*, 111–117. https://doi.org/10.1177/0165025413512064

Lin, H. L., Lawrence, F. R., & Gorrell, J. (2003). Kindergarten teachers' views of children's readiness for school. *Early Childhood Research Quarterly, 18*, 225–237. https://doi.org/10.1016/S0885-2006(03)00028-0

Lindsey, E. W. (2017). Mutual positive emotion with peers, emotion knowledge, and preschoolers' peer acceptance. *Social Development, 26*, 349–366. https://doi.org/10.1111/sode.12201

Locke, R. L., Davidson, R. J., Kalin, N. H., & Goldsmith, H. H. (2009). Children's context inappropriate anger and salivary cortisol. *Developmental Psychology, 45*, 1284–1297. https://doi.org/10.1037/a0015975

López-Pérez, B., Gummerum, M., Wilson, E., & Dellaria, G. (2017). Studying children's intrapersonal emotion regulation strategies from the process model of emotion regulation. *The Journal of Genetic Psychology, 178*, 73–88. https://doi.org/10.1080/00221325.2016.1230085

Lougheed, J. P., Craig, W. M., Pepler, D., Connolly, J., O'Hara, A., Granic, I., & Hollenstein, T. (2016). Maternal and peer regulation of adolescent emotion: Associations with depressive symptoms. *Journal of Abnormal Child Psychology, 44*, 963–974. https://doi.org/10.1007/s10802-015-0084-x

Lougheed, J. P., & Hollenstein, T. (2016). Socioemotional flexibility in mother-daughter dyads: Riding the emotional rollercoaster across positive and negative contexts. *Emotion, 16*, 620–633. https://doi.org/10.1037/emo0000155

Lougheed, J. P., Hollenstein, T., Lichtwarck-Aschoff, A., & Granic, I. (2015). Maternal regulation of child affect in externalizing and typically-developing children. *Journal of Family Psychology, 29*, 10–19. https://doi.org/10.1037/a0038429

Louie, J. Y., Wang, S. W., Fung, J., & Lau, A. (2015). Children's emotional expressivity and teacher perceptions of social competence: A cross-cultural comparison. *International Journal of Behavioral Development, 39*, 497–507. https://doi.org/10.1177/0165025414548775

Luebbe, A. M., Kiel, E. J., & Buss, K. A. (2011). Toddlers' context-varying emotions, maternal responses to emotions, and internalizing behaviors. *Emotion, 11*, 697–703. https://doi.org/10.1037/a0022994

Lugo-Candelas, C., Flegenheimer, C., McDermott, J. M., & Harvey, E. (2017). Emotional understanding, reactivity, and regulation in young children with ADHD symptoms. *Journal of Abnormal Child Psychology, 45*, 1297–1310. https://doi.org/10.1007/s10802-016-0244-7

Malinen, K., Rönkä, A., Tolvanen, A., Sevón, E., & Jokinen, K. (2015). A mobile diary method for studying children's and adolescents' emotions: A pilot study. *Social Inquiry into Well-Being, 1*(2). https://doi.org/10.13165/SIIW-15-1-2-05

Malti, T., & Ongley, S. F. (2014). The development of moral emotions and moral reasoning. In M. Killen & J. G. Smetana (Eds.), *Handbook of moral development* (2nd ed., pp. 163–183). New York, NY: Psychology Press. https://doi.org/10.4324/9780203581957.ch8

Mann, T. D., Hund, A. M., Hesson-McInnis, M. S., & Roman, Z. J. (2017). Pathways to school readiness: Executive functioning predicts academic and social–emotional aspects of school readiness. *Mind, Brain, and Education, 11*, 21–31. https://doi.org/10.1111/mbe.12134

Martin, S. E., Williamson, L. R., Kurtz-Nelson, E. C., & Boekamp, J. R. (2015). Emotion understanding (and misunderstanding) in clinically referred preschoolers: The role of child language and maternal depressive symptoms. *Journal of Child and Family Studies, 24*, 24–37. https://doi.org/10.1007/s10826-013-9810-6

Martins, E. C., Osório, A., Veríssimo, M., & Martins, C. (2016). Emotion understanding in preschool children: The role of executive functions. *International Journal of Behavioral Development, 40*, 1–10. https://doi.org/10.1177/0165025414556096

Mathews, B. L., Koehn, A. J., Abtahi, M. M., & Kerns, K. A. (2016). Emotional competence and anxiety in childhood and adolescence: A meta-analytic review. *Clinical Child and Family Psychology Review, 19*, 162–184. https://doi.org/10.1007/s10567-016-0204-3

McCord, B. L., & Raval, V. V. (2016). Asian Indian immigrant and white American maternal emotion socialization and child socio-emotional functioning. *Journal of Child and Family Studies, 25*, 464–474. https://doi.org/10.1007/s10826-015-0227-2

McElwain, N. L., Halberstadt, A. G., & Volling, B. L. (2007). Mother-and father-reported reactions to

children's negative emotions: Relations to young children's emotional understanding and friendship quality. *Child Development, 78*, 1407–1425. https://doi.org/10.1111/j.1467-8624.2007.01074.x

McKown, C. (2017). Social-emotional assessment, performance, and standards. *The Future of Children, 27*, 157–178.

McKown, C., Russo-Ponsaran, N. M., Allen, A., Johnson, J. K., & Warren-Khot, H. K. (2016). Social–emotional factors and academic outcomes among elementary-aged children. *Infant and Child Development, 25*, 119–136. https://doi.org/10.1002/icd.1926

McQuade, J. D., & Breaux, R. P. (2017). Parent emotion socialization and pre-adolescent's social and emotional adjustment: Moderating effects of autonomic nervous system reactivity. *Biological Psychology, 130*, 67–76. https://doi.org/10.1016/j.biopsycho.2017.10.007

Mesurado, B., Vidal, E. M., & Mestre, A. L. (2018). Negative emotions and behaviour: The role of regulatory emotional self-efficacy. *Journal of Adolescence, 64*, 62–71.

Meyer, S., Raikes, H. A., Virmani, E. A., Waters, S., & Thompson, R. A. (2014). Parent emotion representations and the socialization of emotion regulation in the family. *International Journal of Behavioral Development, 38*, 164–173. https://doi.org/10.1177/0165025413519014

Miller, A. L., Gouley, K. K., Seifer, R., Dickstein, S., & Shields, A. (2004). Emotions and behaviors in the head start classroom: Associations among observed dysregulation, social competence, and preschool adjustment. *Early Education and Development, 15*, 147–165. https://doi.org/10.1207/s15566935eed1502_2

Miller, A. L., Seifer, R., Stroud, L., Sheinkopf, S. J., & Dickstein, S. (2006). Biobehavioral indices of emotion regulation relate to school attitudes, motivation, and behavior problems in a low-income preschool sample. *Annals of the New York Academy of Sciences, 1094*, 325–329. https://doi.org/10.1196/annals.1376.043

Miller-Slough, R., & Dunsmore, J. C. (2016). Parent and friend emotion socialization in adolescence: Associations with psychological adjustment. *Adolescent Research Review, 1*, 287–305. https://doi.org/10.1007/s40894-016-0026-z

Miller-Slough, R. L., Dunsmore, J. C., Zeman, J. L., Sanders, W. M., & Poon, J. A. (2018). Maternal and paternal reactions to child sadness predict children's psychosocial outcomes: A family-centered approach. *Social Development, 27*(3), 495–509. https://doi.org/10.1111/sode.12244

Mirabile, S. P. (2014). Parents' inconsistent emotion socialization and children's socioemotional adjustment. *Journal of Applied Developmental Psychology, 35*, 392–400. https://doi.org/10.1016/j.appdev.2014.06.003

Mirabile, S. P., Oertwig, D., & Halberstadt, A. G. (2018). Parent emotion socialization and children's socioemotional adjustment: When is supportiveness no longer supportive? *Social Development, 27*(3), 466–481. https://doi.org/10.1111/sode.12226

Moradi Siah Afshadi, M., Amiri, S., & Molavi, H. (2017). Testing the model of attachment, facial emotion recognition, emotion regulation, emotional perspective taking, and depression in female adolescents. *Journal of Practice in Clinical Psychology, 5*, 33–44. https://doi.org/10.18869/acadpub.jpcp.5.1.33

Morales, S., Ram, N., Buss, K. A., Cole, P. M., Helm, J. L., & Chow, S. M. (2018). Age-related changes in the dynamics of fear-related regulation in early childhood. *Developmental Science, 21*(5), e12633. Online only.

Moran, L. R., Lengua, L. J., & Zalewski, M. (2013). The interaction between negative emotionality and effortful control in early social-emotional development. *Social Development, 22*, 340–362. https://doi.org/10.1111/sode.12025

Morelen, D., Shaffer, A., & Suveg, C. (2016). Maternal emotion regulation: Links to emotion parenting and child emotion regulation. *Journal of Family Issues, 37*, 1891–1916. https://doi.org/10.1177/0192513X14546720

Morelen, D., & Suveg, C. (2012). A real-time analysis of parent-child emotion discussions: The interaction is reciprocal. *Journal of Family Psychology, 26*, 998-1003. https://doi.org/10.1037/a0030148

Morgan, J. K., Izard, C. E., & Hyde, C. (2014). Emotional reactivity and regulation in Head Start children: Links to ecologically valid behaviors and internalizing problems. *Social Development, 23*, 250–266. https://doi.org/10.1111/sode.12049

Morris, A. S., Silk, J. S., Steinberg, L., Terranova, A. M., & Kithakye, M. (2010). Concurrent and longitudinal links between children's externalizing behavior in school and observed anger regulation in the mother–child dyad. *Journal of Psychopathology and Behavioral Assessment, 32*, 48–56. https://doi.org/10.1007/s10862-009-9166-9

Morris, A. S., Silk, J. S., Morris, M. D. S., Steinberg, L., Aucoin, K. J., & Keyes, A. W. (2011). The influence of mother–child emotion regulation strategies on children's expression of anger and sadness. *Developmental Psychology, 47*, 213–225.

Morris, C. S., Denham, S. A., Bassett, H. H., & Curby, T. (2013). Relations among teachers' emotion socialization beliefs and practices, and preschoolers' emotional competence. *Early Education and Development, 24*, 979–999. https://doi.org/10.1080/10409289.2013.825186

Morris, N., Keane, S., Calkins, S., Shanahan, L., & O'Brien, M. (2014). Differential components of reactivity and attentional control predicting externalizing behavior. *Journal of Applied Developmental Psychology, 35*, 121–127. https://doi.org/10.1016/j.appdev.2014.02.002

Murphy, B. C., Eisenberg, N., Fabes, R. A., Shepard, S., & Guthrie, I. K. (1999). Consistency and change in children's emotionality and regulation: A longitudinal study. *Merrill-Palmer Quarterly, 45*, 413–444.

Nakamichi, K. (2017). Differences in young children's peer preference by inhibitory control and emotion regulation. *Psychological reports, 120*(5), 805–823.

Nelson, J. A., Leerkes, E. M., Perry, N. B., O'Brien, M., Calkins, S. D., & Marcovitch, S. (2013). European-American and African-American mothers' emotion socialization practices relate differently to their children's academic and social-emotional competence. *Social Development, 22*, 485–498. https://doi.org/10.1111/j.1467-9507.2012.00673.x

Newland, R. P., & Crnic, K. A. (2011). Mother–child affect and emotion socialization processes across the late preschool period: Predictions of emerging behaviour problems. *Infant and Child Development, 20*, 371–388. https://doi.org/10.1002/icd.729

Nix, R. L., Bierman, K. L., Domitrovich, C. E., & Gill, S. (2013). Promoting children's social-emotional skills in preschool can enhance academic and behavioral functioning in kindergarten: Findings from Head Start REDI. *Early Education & Development, 24*, 1000–1019. https://doi.org/10.1080/10409289.2013.825565

Oberle, E., Schonert-Reichl, K. A., Hertzman, C., & Zumbo, B. D. (2014). Social–emotional competencies make the grade: Predicting academic success in early adolescence. *Journal of Applied Developmental Psychology, 35*, 138–147. https://doi.org/10.1016/j.appdev.2014.02.004

Ornaghi, V., Brockmeier, J., & Grazzani, I. (2014). Enhancing social cognition by training children in emotion understanding: A primary school study. *Journal of Experimental Child Psychology, 119*, 26–39. https://doi.org/10.1016/j.jecp.2013.10.005

Ornaghi, V., Grazzani, I., Cherubin, E., Conte, E., & Piralli, F. (2015). "Let's talk about emotions!". The effect of conversational training on preschoolers' emotion comprehension and prosocial orientation. *Social Development, 24*, 166–183. https://doi.org/10.1111/sode.12091

Orta, I. M., Çorapçı, F., Yagmurlu, B., & Aksan, N. (2013). The mediational role of effortful control and emotional dysregulation in the link between maternal responsiveness and Turkish preschoolers' social competency and externalizing symptoms. *Infant and Child Development, 22*, 459–479. https://doi.org/10.1002/icd.1806

Öztürk Samur, A. (2015). A study on the relationship between externalising behaviours and emotional skills of 60–72-month-old children. *Early Child Development and Care, 185*(1), 75–83.

Parker, A. E., Mathis, E. T., & Kupersmidt, J. B. (2013). How is this child feeling? Preschool-aged children's ability to recognize emotion in faces and body poses. *Early Education & Development, 24*, 188–211. https://doi.org/10.1080/10409289.2012.657536

Payton, J. W., Wardlaw, D. M., Graczyk, P. A., Bloodworth, M. R., Tompsett, C. J., & Weissberg, R. P. (2000). Social and emotional learning: A framework for promoting mental health and reducing risk behaviors in children and youth. *Journal of School Health, 70*(5), 179–185. https://doi.org/10.1111/j.1746-1561.2000.tb06468.x

Pekrun, R. (2017). Emotion and achievement during adolescence. *Child Development Perspectives, 11*, 215–221. https://doi.org/10.1111/cdep.12237

Pekrun, R., & Linnenbrink-Garcia, L. (2012). Academic emotions and student engagement. In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (pp. 259–282). Boston, MA: Springer. https://doi.org/10.1007/978-1-4614-2018-7_12

Penela, E. C., Walker, O. L., Degnan, K. A., Fox, N. A., & Henderson, H. A. (2015). Early behavioral inhibition and emotion regulation: Pathways toward social competence in middle childhood. *Child Development, 86*, 1227–1240. https://doi.org/10.1111/cdev.12384

Perry, N. B., Calkins, S. D., Nelson, J. A., Leerkes, E. M., & Marcovitch, S. (2012). Mothers' responses to children's negative emotions and child emotion regulation: The moderating role of vagal suppression. *Developmental Psychobiology, 54*, 503–513. https://doi.org/10.1002/dev.20608

Pintar Breen, A. I., Tamis-LeMonda, C. S., & Kahana-Kalman, R. (2018). Latina mothers' emotion socialization and their children's emotion knowledge. *Infant and Child Development, 27*(12), e2077.

Piotrkowski, C. S., Botsko, M., & Matthews, E. (2000). Parents' and teachers' beliefs about children's school readiness in a high-need community. *Early Childhood Research Quarterly, 15*, 537–558. https://doi.org/10.1016/S0885-2006(01)00072-2

Pons, F., & Harris, P. (2005). Longitudinal change and longitudinal stability of individual differences in children's emotion understanding. *Cognition & Emotion, 19*, 1158–1174. https://doi.org/10.1080/02699930500282108

Pons, F., Harris, P. L., & de Rosnay, M. (2004). Emotion comprehension between 3 and 11 years: Developmental periods and hierarchical organization. *European Journal of Developmental Psychology, 1*, 127–152. https://doi.org/10.1080/17405620344000022

Poon, J., Zeman, J., Miller-Slough, R., Sanders, W., & Crespo, L. (2017). "Good enough" parental responsiveness to Children's sadness: Links to psychosocial functioning. *Journal of Applied Developmental Psychology, 48*, 69–78. https://doi.org/10.1016/j.appdev.2016.11.005

Poulou, M. (2005). The prevention of emotional and behavioural difficulties in schools: Teachers' suggestions. *Educational Psychology in Practice, 21*, 37–52. https://doi.org/10.1080/02667360500035181

Premo, J. E., & Kiel, E. J. (2014). The effect of toddler emotion regulation on maternal emotion socialization: Moderation by toddler gender. *Emotion, 14*, 782–793. https://doi.org/10.1037/a0036684

Raver, C., & Spagnola, M. (2003). "When my mommy was angry, I was speechless": Children's perceptions of maternal emotional expressiveness within the context of economic hardship. *Marriage & Family Review, 34*(1–2), 63–88. https://doi.org/10.1300/J002v34n01_04

Remmes, C. S., & Ehrenreich-May, J. (2014). Parental emotion regulation strategy use and responses to youth negative affect. *Journal of Cognitive Psychotherapy, 28*, 34–47. https://doi.org/10.1891/0889-8391.28.1.34

Rhoades, B. L., Warren, H. K., Domitrovich, C. E., & Greenberg, M. T. (2011). Examining the link between preschool social–emotional competence and first grade academic achievement: The role of attention skills. *Early Childhood Research Quarterly, 26*, 182–191. https://doi.org/10.1016/j.ecresq.2010.07.003

Rimm-Kaufman, S. E., Pianta, R. C., & Cox, M. J. (2000). Teachers' judgments of problems in the transition to kindergarten. *Early Childhood Research Quarterly, 15*, 147–166. https://doi.org/10.1016/S0885-2006(00)00049-1

Rivers, S. E., Brackett, M. A., Reyes, M. R., Mayer, J. D., Caruso, D. R., & Salovey, P. (2012). Measuring emotional intelligence in early adolescence with the MSCEIT-YV: Psychometric properties and relationship with academic performance and psychosocial functioning. *Journal of Psychoeducational Assessment, 30*, 344–366. https://doi.org/10.1177/0734282912449443

Roben, C. K., Cole, P. M., & Armstrong, L. M. (2013). Longitudinal relations among language skills, anger expression, and regulatory strategies in early childhood. *Child Development, 84*, 891–905. https://doi.org/10.1111/cdev.12027

Rodrigo-Ruiz, D., Perez-Gonzalez, J. C., & Cejudo, J. (2017). Emotional facial recognition difficulties as primary deficit in children with attention deficit hyperactivity disorder: A systematic review. *Revista de Neurologica, 65*(4), 145–152.

Rogers, M. L., Halberstadt, A. G., Castro, V. L., MacCormack, J. K., & Garrett-Peters, P. (2016). Maternal emotion socialization differentially predicts third-grade children's emotion regulation and lability. *Emotion, 16*, 280–291. https://doi.org/10.1037/emo0000142

Romano, E., Babchishin, L., Pagani, L. S., & Kohen, D. (2010). School readiness and later achievement: Replication and extension using a nationwide Canadian survey. *Developmental Psychology, 46*, 995-1007. https://doi.org/10.1037/a0018880

Rose, A. J., Schwartz-Mette, R. A., Glick, G. C., Smith, R. L., & Luebbe, A. M. (2014). An observational study of co-rumination in adolescent friendships. *Developmental Psychology, 50*, 2199-2209. https://doi.org/10.1037/a0037465

Ross, J. (2017). You and me: Investigating the role of self-evaluative emotion in preschool prosociality. *Journal of Experimental Child Psychology, 155*, 67–83. https://doi.org/10.1016/j.jecp.2016.11.001

Ren, Y., Wyver, S., Xu Rattanasone, N., & Demuth, K. (2016). Social competence and language skills in Mandarin–English bilingual preschoolers: The moderation effect of emotion regulation. *Early Education and Development, 27*, 303–317.

Root, A. K., & Denham, S. A. (2010). The role of gender in the socialization of emotion: Key concepts and critical issues. In A. K. Root & S. A. Denham (eds.), The role of parent and child gender in the socialization of emotional competence. *New Directions for Child and Adolescent Development* (pp. 1–10). San Francisco: Jossey- Bass.

Saarni, C. (1997). Coping with aversive feelings. *Motivation and Emotion, 21*, 45–63. https://doi.org/10.1023/A:1024474314409

Saarni, C. (1999). *Children's emotional competence*. New York, NY: Guilford Press.

Sala, M. N., Pons, F., & Molina, P. (2014). Emotion regulation strategies in preschool children. *British Journal of Developmental Psychology, 32*, 440–453. https://doi.org/10.1111/bjdp.12055

Salmon, K., & Reese, E. (2016). The benefits of reminiscing with young children. *Current Directions in Psychological Science, 25*, 233–238. https://doi.org/10.1177/0963721416655100

Sanders, W., Zeman, J., Poon, J., & Miller, R. (2015). Child regulation of negative emotions and depressive symptoms: The moderating role of parental emotion socialization. *Journal of Child and Family Studies, 24*, 402–415. https://doi.org/10.1007/s10826-013-9850-y

Sawada, T. (1997). Development of children's understanding of emotional dissemblance in another person. *Japanese Journal of Educational Psychology, 45*, 50–59. https://doi.org/10.5926/jjep1953.45.4_416

Schneider, R. L., Arch, J. J., Landy, L. N., & Hankin, B. L. (2018). The longitudinal effect of emotion regulation strategies on anxiety levels in children and adolescents. *Journal of Clinical Child & Adolescent Psychology, 47*(6), 978–991. https://doi.org/10.1080/15374416.2016.1157757

Schonert-Reichl, K. A., Kitil, M. J., & Hanson-Peterson, J. (2017). *To reach the students, teach the teachers: A national scan of teacher preparation and social and emotional learning. A report prepared for the Collaborative for Academic, Social, and Emotional Learning (CASEL)*. Vancouver, BC: University of British Columbia.

Schultz, D., Izard, C. E., & Ackerman, B. P. (2000). Children's anger attribution bias: Relations to family environment and social adjustment. *Social Development, 9*, 284–301. https://doi.org/10.1111/1467-9507.00126

Scrimgeour, M. B., Davis, E. L., & Buss, K. A. (2016). You get what you get and you don't throw a fit!: Emotion socialization and child physiology jointly predict early prosocial development. *Developmental Psychology, 52*, 102–116. https://doi.org/10.1037/dev0000071

Seidenfeld, A. M., Johnson, S. R., Cavadel, E. W., & Izard, C. E. (2014). Theory of mind predicts emotion knowledge development in head start children. *Early Education and Development, 25*, 933–948. https://doi.org/10.1080/10409289.2014.883587

Sendzik, L., Schäfer, J. Ö., Samson, A. C., Naumann, E., & Tuschen-Caffier, B. (2017). Emotional awareness in depressive and anxiety symptoms in youth: A meta-analytic review. *Journal of Youth and Adolescence, 46*, 687–700. https://doi.org/10.1007/s10964-017-0629-0

Sette, S., Bassett, H. H., Baumgardner, E., & Denham, S. A. (2015). Structure and validity of affect knowledge test in a sample of Italian preschoolers. *Journal*

of Genetic Psychology, 176, 330–347. https://doi.org/10.1080/00221325.2015.1075466

Sette, S., Baumgartner, E., Laghi, F., & Coplan, R. J. (2016). The role of emotion knowledge in the links between shyness and children's socio-emotional functioning at preschool. *British Journal of Developmental Psychology, 34*, 471–488. https://doi.org/10.1111/bjdp.12144

Sharp, K. M. H., Cohen, R., Kitzmann, K. M., & Parra, G. R. (2016). Mechanisms mediating children's perceived maternal nonsupportive reactions to sadness and children's social and emotional functioning. *Journal of Child and Family Studies, 25*, 367–380. https://doi.org/10.1007/s10826-015-0240-5

Shields, A., Dickstein, S., Seifer, R., Giusti, L., Dodge Magee, K., & Spritz, B. (2001). Emotional competence and early school adjustment: A study of preschoolers at risk. *Early Education and Development, 12*, 73–96.

Shin, N., Vaughn, B. E., Akers, V., Kim, M., Stevens, S., Krzysik, L., … Korth, B. (2011). Are happy children socially successful? Testing a central premise of positive psychology in a sample of preschool children. *The Journal of Positive Psychology, 6*, 355–367. https://doi.org/10.1080/17439760.2011.584549

Shortt, J. W., Katz, L. F., Allen, N. B., Leve, C., Davis, B., & Sheeber, L. B. (2016). Emotion socialization in the context of risk and psychopathology: Mother and father socialization of anger and sadness in adolescents with depressive disorder. *Social Development, 25*, 27–46. https://doi.org/10.1111/sode.12138

Shortt, J. W., Stoolmiller, M., Smith-Shine, J. N., Mark Eddy, J., & Sheeber, L. (2010). Maternal emotion coaching, adolescent anger regulation, and siblings' externalizing symptoms. *Journal of Child Psychology and Psychiatry, 51*, 799–808. https://doi.org/10.1111/j.1469-7610.2009.02207.x

Silk, J. S., Steinberg, L., & Morris, A. S. (2003). Adolescents' emotion regulation in daily life: Links to depressive symptoms and problem behavior. *Child Development, 74*, 1869–1880. https://doi.org/10.1046/j.1467-8624.2003.00643.x

Silva, E., Freire, T., & Faria, S. (2018). The emotion regulation strategies of adolescents and their parents: An experience sampling study. *Journal of Child and Family Studies, 27*(6), 1774–1785. https://doi.org/10.1007/s10826-018-1015-6

Sklad, M., Diekstra, R., Ritter, M. D., Ben, J., & Gravesteijn, C. (2012). Effectiveness of school-based universal social, emotional, and behavioral programs: Do they enhance students' development in the area of skill, behavior, and adjustment? *Psychology in the Schools, 49*, 892–909. https://doi.org/10.1002/pits.21641

Son, S. H. C., & Chang, Y. E. (2018). Childcare experiences and early school outcomes: The mediating role of executive functions and emotionality. *Infant and Child Development, 27*(4), e2087. https://doi.org/10.1002/icd.2087

Song, J. H., & Trommsdorff, G. (2016). Linking maternal emotion socialization to boys' and girls' emotion regulation in Korea. *Child Studies in Asia-Pacific Contexts, 6*(2), 47–57. https://doi.org/10.5723/csac.2016.6.2.047

Spinrad, T. L., Stifter, C. A., Donelan-McCall, N., & Turner, L. (2004). Mothers' regulation strategies in response to toddlers' affect: Links to later emotion self-regulation. *Social Development, 13*, 40–55. https://doi.org/10.1037/0012-1649.43.5.1170

Spivak, A. L., & Farran, D. C. (2016). Predicting first graders' social competence from their preschool classroom interpersonal context. *Early Education and Development, 27*, 735–750. https://doi.org/10.1080/10409289.2016.1138825

Spritz, B. L., Sandberg, E. H., Maher, E., & Zajdel, R. T. (2010). Models of emotion skills and social competence in the Head Start classroom. *Early Education and Development, 21*, 495–516. https://doi.org/10.1080/10409280902895097

Steed, E. A., & Roach, A. T. (2017). Childcare Providers' Use of practices to promote young children's social–emotional competence. *Infants & Young Children, 30*, 162–171. https://doi.org/10.1097/IYC.0000000000000092

Stocker, C. M., Richmond, M. K., Rhoades, G. K., & Kiang, L. (2007). Family emotional processes and adolescents' adjustment. *Social Development, 16*, 310–325. https://doi.org/10.1111/j.1467-9507.2007.00386.x

Stone, L. B., Silk, J. S., Oppenheimer, C. W., Benoit Allen, K., Waller, J. M., & Dahl, R. E. (2017). Linking maternal socialization of emotion regulation to adolescents' co-rumination with peers. *Journal of Early Adolescence, 37*, 1341–1355. https://doi.org/10.1177/0272431616659558

Strand, P. S., Downs, A., & Barbosa-Leiker, C. (2016). Does facial expression recognition provide a toehold for the development of emotion understanding? Developmental Psychology, 52, 1182–1191. https://doi.org/10.1037/dev0000144

Suveg, C., Sood, E., Barmish, A., Tiwari, S., Hudson, J. L., & Kendall, P. C. (2008). "I'd rather not talk about it": Emotion parenting in families of children with an anxiety disorder. *Journal of Family Psychology, 22*, 875–884. https://doi.org/10.1037/a0012861

Suveg, C., Zeman, J., Flannery-Schroeder, E., & Cassano, M. (2005). Emotion socialization in families of children with an anxiety disorder. *Journal of Abnormal Child Psychology, 33*, 145–155. https://doi.org/10.1007/s10802-005-1823-1

Swartz, R. A., & McElwain, N. L. (2012). Preservice teachers' emotion-related regulation and cognition: Associations with teachers' responses to children's emotions in early childhood classrooms. *Early Education & Development, 23*, 202–226. https://doi.org/10.1080/10409289.2012.619392

Székely, E., Lucassen, N., Tiemeier, H., Bakermans-Kranenburg, M. J., Van Ijzendoorn, M. H., Kok, R., ... & Herba, C. M. (2014). Maternal depressive symptoms and sensitivity are related to young children's facial expression recognition: The Generation R study. *Development and Psychopathology, 26*, 333–345. https://doi.org/10.1017/S0954579413001028

Taylor, R. D., Oberle, E., Durlak, J. A., & Weissberg, R. P. (2017). promoting positive youth development through school-based social and emotional learning interventions: A meta-analysis of follow-up effects. *Child Development, 88*, 1156–1171. https://doi.org/10.1111/cdev.12864

Taylor, Z. E., Eisenberg, N., VanSchyndel, S. K., Eggum-Wilkens, N. D., & Spinrad, T. L. (2014). Children's negative emotions and ego-resiliency: Longitudinal relations with social competence. *Emotion, 14*, 397–406. https://doi.org/10.1037/a0035079

Thomassin, K., & Suveg, C. (2014). Reciprocal positive affect and well-regulated, adjusted children: A unique contribution of fathers. *Parenting, 14*, 28–46. https://doi.org/10.1080/15295192.2014.880017

Thomassin, K., Suveg, C., Davis, M., Lavner, J. A., & Beach, S. R. (2017). Coparental affect, children's emotion dysregulation, and parent and child depressive symptoms. *Family Process, 56*, 126–140. https://doi.org/10.1111/famp.12184

Thompson, R. A. (1994). Emotion regulation: A theme in search of definition. In N. A. Fox (Ed.), *The development of emotion regulation: Biological and behavioral considerations* (Monographs of the Society for Research in Child Development, Serial No. 240, 259 (242–243)) (pp. 225–252). Chicago, IL: University of Chicago Press.

Thompson, R. A., & Calkins, S. D. (1996). The double-edged sword: Emotional regulation for children at risk. *Development and Psychopathology, 8*, 163–182. https://doi.org/10.1017/S0954579400007021

Thorell, L. B., Sjöwall, D., Diamatopoulou, S., Rydell, A. M., & Bohlin, G. (2017). Emotional functioning, ADHD symptoms, and peer problems: A longitudinal investigation of children age 6–9.5 years. *Infant and Child Development, 26*. https://doi.org/10.1002/icd.2008

Torres, M. M., Domitrovich, C. E., & Bierman, K. L. (2015). Preschool interpersonal relationships predict kindergarten achievement: Mediated by gains in emotion knowledge. *Journal of Applied Developmental Psychology, 39*, 44–52. https://doi.org/10.1016/j.appdev.2015.04.008

Trentacosta, C. J., & Fine, S. E. (2010). Emotion knowledge, social competence, and behavior problems in childhood and adolescence: A meta-analytic review. *Social Development, 19*, 1–29. https://doi.org/10.1111/j.1467-9507.2009.00543.x

Trentacosta, C. J., & Izard, C. E. (2007). Kindergarten children's emotion competence as a predictor of their academic competence in first grade. *Emotion, 7*, 77–88. https://doi.org/10.1037/1528-3542.7.1.77

Trommsdorff, G., & Cole, P. M. (2011). Emotion, self-regulation, and social behavior in cultural contexts. In X. Chen & K. H. Rubin (Eds.), *Social, emotional, and personality development in context. Socioemotional development in cultural context* (pp. 131–163). New York, NY: Guilford Press.

Ulrich, F., & Petermann, F. (2017). Parental emotion dysregulation as a risk factor for child development. *Kindheit und Entwicklung, 26*(3), 133–146. https://doi.org/10.1026/0942-5403/a000225

von Salisch, M. (2000). *Wenn kinder sich ärgern. Emotionsregulierung in der entwicklung*. Göttingen, Germany: Hogrefe Verlag.

von Salisch, M. (2008). Ärger–Aushandlungen in der Freundschaft als Weg zu sozialer und emotionaler Kompetenz. In *Kinderleben–Individuelle Entwicklungen in sozialen Kontexten* (pp. 81–97). VS Verlag für Sozialwissenschaften.

von Salisch, M. (2018). Emotional competence and friendship involvement: Spiral effects in adolescence. *European Journal of Developmental Psychology, 15*(6), 678–693. https://doi.org/10.1080/17405629.2017.1422720. Online only.

von Salisch, M., Haenel, M., & Denham, S. A. (2015). Self-regulation, language skills, and emotion knowledge in young children from Northern Germany. *Early Education and Development, 26*, 792–806. https://doi.org/10.1080/10409289.2015.994465

von Salisch, M., Haenel, M., & Freund, P. A. (2013). Emotion understanding and cognitive abilities in young children. *Learning and Individual Differences, 26*, 15–19. https://doi.org/10.1016/j.lindif.2013.04.001

von Salisch, M., & Janke, B. (2010). Development of emotional competence in the preschool age. *Praxis der Kinderpsychologie und Kinderpsychiatrie, 59*, 509–512.

von Salisch, M., Zeman, J., Luepschen, N., & Kanevski, R. (2014). Prospective relations between adolescents' social-emotional competencies and their friendships. *Social Development, 23*, 684–701.

von Salisch, M., & Zeman, J. L. (2018). Pathways to reciprocated friendships: A cross-lagged panel study on young adolescents' anger regulation towards friends. *Journal of Youth and Adolescence, 47*, 673–687. https://doi.org/10.1007/s10964-017-0683-7

Valiente, C., Lemery-Chalfant, K., & Swanson, J. (2010). Prediction of kindergartners' academic achievement from their effortful control and emotionality: Evidence for direct and moderated relations. *Journal of Educational Psychology, 102*, 550–560. https://doi.org/10.1037/a0018992

Van der Giessen, D., & Bögels, S. M. (2018). Father-child and mother-child interactions with children with anxiety disorders: Emotional expressivity and flexibility of dyads. *Journal of Abnormal Child Psychology, 46*, 331–342. https://doi.org/10.1007/s10802-017-0271-z

Voltmer, K., & von Salisch, M. (2017). Three meta-analyses of children's emotion knowledge and their school success. *Learning and Individual Differences, 59*, 107–118. https://doi.org/10.1016/j.lindif.2017.08.006

Waajid, B., Garner, P. W., & Owen, J. E. (2013). Infusing social emotional learning into the teacher education curriculum. *The International Journal of Emotional Education, 5*, 31–48.

Walle, E. A., & Campos, J. J. (2012). Interpersonal responding to discrete emotions: A functionalist approach to the development of affect specificity. *Emotion Review, 4*, 413–422. https://doi.org/10.1177/1754073912445812

Wan, K. P., & Savina, E. (2016). Emotion regulation strategies in European American and Hong Kong Chinese middle school children. *Contemporary School Psychology, 20*, 152–159. https://doi.org/10.1007/s40688-015-0059-5

Waters, S. F., & Thompson, R. A. (2014). Children's perceptions of the effectiveness of strategies for regulating anger and sadness. *International Journal of Behavioral Development, 38*, 174–181. https://doi.org/10.1177/0165025413515410

Watson, A. C., & Nixon, C. L. (2001). Family experiences and early emotion understanding. *Merrill-Palmer Quarterly, 47*, 300–322. https://doi.org/10.1353/mpq.2001.0011

Wesley, P. W., & Buysse, V. (2003). Making meaning of school readiness in schools and communities. *Early Childhood Research Quarterly, 18*, 351–375. https://doi.org/10.1016/S0885-2006(03)00044-9

Wills, T. A., Simons, J. S., Sussman, S., & Knight, R. (2016). Emotional self-control and dysregulation: A dual-process analysis of pathways to externalizing/internalizing symptomatology and positive well-being in younger adolescents. *Drug & Alcohol Dependence, 163*, S37–S45. https://doi.org/10.1016/j.drugalcdep.2015.08.039

Wilson, K. R., Havighurst, S. S., & Harley, A. E. (2014). Dads Tuning In To Kids: Piloting a new parenting program targeting fathers' emotion coaching skills. *Journal of Community Psychology, 42*, 162–168. https://doi.org/10.1002/jcop.21601

Wong, M. S., Diener, M. L., & Isabella, R. A. (2008). Parents' emotion related beliefs and behaviors and child grade: Associations with children's perceptions of peer competence. *Journal of Applied Developmental Psychology, 29*, 175–186. https://doi.org/10.1016/j.appdev.2008.02.003

Wong, M. S., McElwain, N. L., & Halberstadt, A. G. (2009). Parent, family, and child characteristics: Associations with mother-and father-reported emotion socialization practices. *Journal of Family Psychology, 23*, 452–463. https://doi.org/10.1037/a0015552

Woods, S. E., Menna, R., & McAndrew, A. J. (2017). The mediating role of emotional control in the link between parenting and young children's physical aggression. *Early Child Development and Care, 187*, 1157–1169. https://doi.org/10.1080/03004430.2016.1159204

Yap, M. B., Allen, N. B., & Ladouceur, C. D. (2008). Maternal socialization of positive affect: The impact of invalidation on adolescent emotion regulation and depressive symptomatology. *Child Cevelopment, 79*, 1415–1431. https://doi.org/10.1111/j.1467-8624.2008.01196.x

Yap, M. B., Schwartz, O. S., Byrne, M. L., Simmons, J. G., & Allen, N. B. (2010). Maternal positive and negative interaction behaviors and early adolescents' depressive symptoms: Adolescent emotion regulation as a mediator. *Journal of Research on Adolescence, 20*, 1014–1043. https://doi.org/10.1111/j.1532-7795.2010.00665.x

Yelinek, J., & Grady, J. S. (2017). "Show me your mad faces!" Preschool teachers' emotion talk in the classroom. *Early Child Development and Care*. Online First. https://doi.org/10.1080/03004430.2017.1363740

Yeo, K., Frydenberg, E., Northam, E., & Deans, J. (2014). Coping with stress among preschool children and associations with anxiety level and controllability of situations. *Australian Journal of Psychology, 66*, 93–101. https://doi.org/10.1111/ajpy.12047

Yi, C. Y., Gentzler, A. L., Ramsey, M. A., & Root, A. E. (2016). Linking maternal socialization of positive emotions to children's behavioral problems: The moderating role of self-control. *Journal of Child and Family Studies, 25*, 1550–1558. https://doi.org/10.1007/s10826-015-0329-x

Yu, T., Volling, B. L., & Niu, W. (2015). Emotion socialization and children's behavioral problems in China and the United States. *Journal of Comparative Family Studies, 46*, 419–434.

Zajdel, R. T., Bloom, J. M., Fireman, G., & Larsen, J. (2013). Children's understanding and experience of mixed emotions: The roles of age, gender, and empathy. *The Journal of Genetic Psychology, 174*, 582–603. https://doi.org/10.1080/00221325.2012.732125

Zeman, J., & Shipman, K. (1996). Children's expression of negative affect: Reasons and methods. *Developmental Psychology, 32*, 842–849. https://doi.org/10.1037/0012-1649.32.5.842

Zembylas, M. (2007). Emotional ecology: The intersection of emotional knowledge and pedagogical content knowledge in teaching. *Teaching and Teacher Education, 23*, 355–367. https://doi.org/10.1016/j.tate.2006.12.002

Zinsser, K. M., Denham, S. A., Curby, T. W., & Shewark, E. A. (2015). "Practice What You Preach": Teachers' perceptions of emotional competence and emotionally supportive classroom practices. *Early Education and Development, 26*, 899–919. https://doi.org/10.1080/10409289.2015.1009320

Zinsser, K. M., Shewark, E. A., Denham, S. A., & Curby, T. W. (2014). A mixed-method examination of preschool teacher beliefs about social–emotional learning and relations to observed emotional support. *Infant and Child Development, 23*, 471–493. https://doi.org/10.1002/icd.1843

Emotions in Contexts of Conflict and Morality: Developmental Perspectives

Tina Malti, Linlin Zhang, Eleanor Myatt, Joanna Peplak, and Erinn L. Acland

Abstract

In recent decades, developmental scientists have increasingly studied the functional and adaptive roles of emotions in the context of conflict and morality. Yet, disagreements remain over what the core emotional experiences are, how they develop, and how they are linked to adaptive and maladaptive behaviors across childhood and adolescence. Here, we start by conceptualizing emotions and their development in the context of morality. We then describe an integrative clinical-developmental framework of emotions in moral contexts. Next, we introduce our taxonomy of emotions to help guide contemporary theorizing on emotions. This model proposes two central categorizations of emotions in the context of morality: valence (positive versus negative) and orientation (self versus other). The chapter then elaborates upon the developmental processes involved in the experience of distinct emotions within moral contexts. This is followed by a review of current research on temperamental and socialization pathways of these emotions and how they are associated with other-oriented and harmful behaviors. We conclude by highlighting promising future directions for research on the development of emotions in the context of conflict and morality.

Humans are social creatures and inevitably encounter dilemmas when interacting with others in everyday life. Social interactions tend to be complex and multifaceted and often involve moral issues, i.e., concerns about fairness, justice, or the welfare of others. It is also quite natural that such contexts arouse strong feelings in most (if not all) involved individuals. This is because they often elicit opposing motives in the person, between dyads and/or between groups. For instance, an interpersonal conflict between two individuals can involve conflicting needs, feelings, and desires. Such conflicting motives can also occur within an individual (e.g., self-oriented concerns versus other-oriented motivations; see Fig. 1). Emotional experiences in these contexts influence the way we evaluate and reason about such conflicts, and eventually act as a consequence. As such, they are considered

This work was supported by the Social Sciences and Humanities Research Council of Canada (SSHRC) and the Natural Sciences and Engineering Research Council of Canada (NSERC).

T. Malti (✉)
Department of Psychiatry and Psychology, University of Toronto, Toronto, ON, Canada
e-mail: tina.malti@utoronto.ca

L. Zhang · E. Myatt · J. Peplak · E. L. Acland
Department of Psychology, University of Toronto Mississauga, Toronto, ON, Canada

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_21

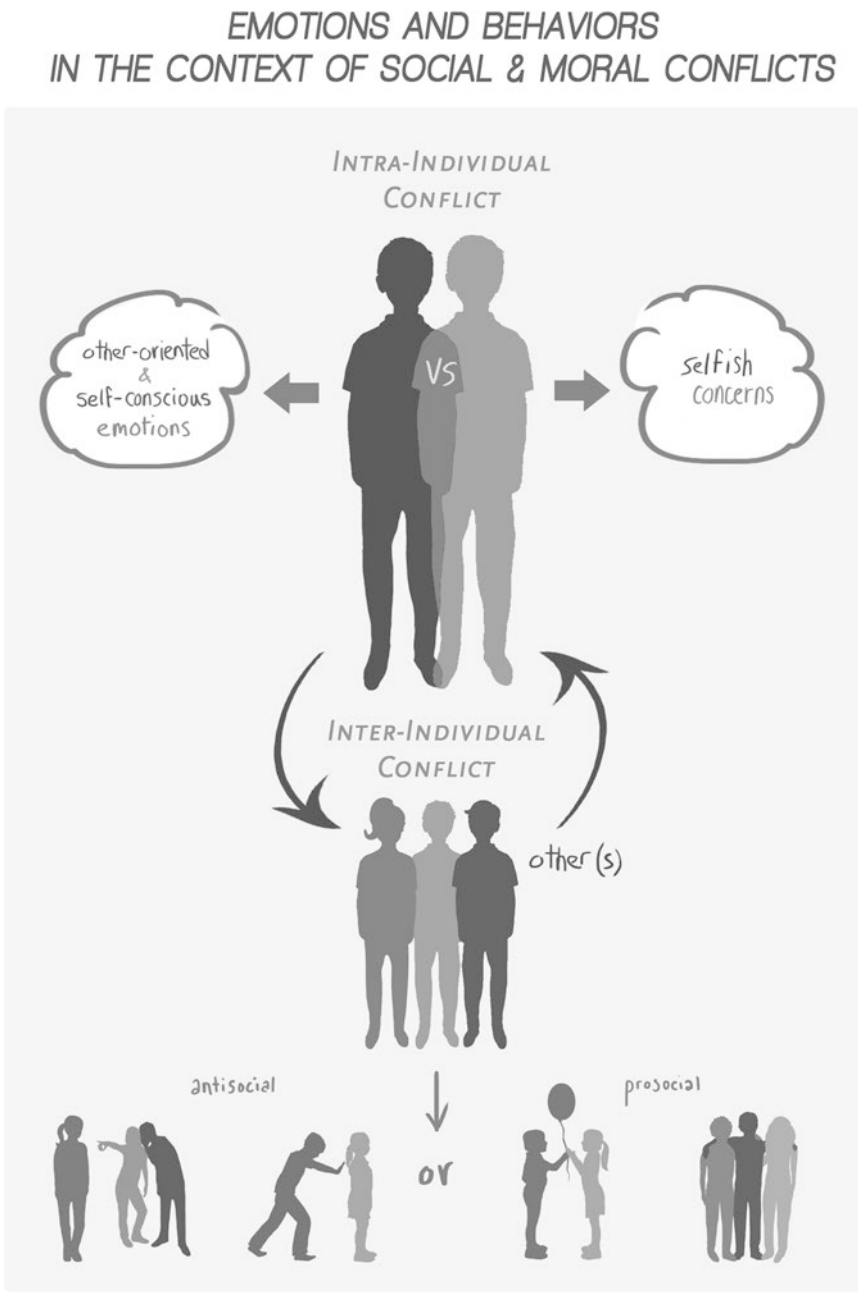

Fig. 1 A model of intraindividual (i.e., kind emotions vs. self-oriented concerns) and interindividual (individual vs. other(s)) conflicts and their role in antisocial and prosocial behaviors

important components if we are to understand why humans behave the way they do in complex social and moral encounters. But how do these emotional experiences develop and how do they motivate our actions?

In this chapter we describe how emotions in the context of conflict and morality develop, and how they relate to other-oriented and self-oriented behaviors. We begin by conceptualizing emotions in the context of conflict and morality

and introducing our taxonomy of emotions. We introduce and discuss four prototypical emotions in contexts of morality that are distinguished by valence and orientation: guilt, sympathy, pride, and respect. We then present a clinical-developmental perspective on moral emotions, which elaborates on the biological, cognitive, and contextual factors associated with the emergence and the various pathways involved in distinct types of emotions, as well as the consequences for behavioral outcomes. Next, we review the literature on the development of distinct moral emotions. Additionally, we discuss links between moral emotions and the expression of other-oriented and harmful behaviors, such as helping, comforting, and physical aggression. Lastly, we highlight gaps in the current literature and offer potential future directions in the study of emotions in context of conflict and morality through a developmental lens.

What Are Moral Emotions?

Moral emotions reflect internalized principles regarding the welfare of others, and of justice and fairness. They are theorized to be the motivational forces behind doing "good" and avoiding doing "bad" (Malti, 2016; Malti & Latzko, 2017; see Tangney, Stuewig, & Mashek, 2007). Moral emotions are similar to basic emotions and other nonmorally relevant emotions in their ontogenesis, but are distinct in their cognitive and contextual elicitors. For example, the negative feeling of experiencing sympathy may be similar to experiences of sadness; however, sympathy is tied to morally relevant contexts that involve a needy other, whereas sadness is less contextually bound. Similar to other emotions, moral emotions arise in response to appraising a stimulus or an event (Frijda, 1994; Lazarus, 1991), and evoke physiological responses such as changes in heart rate (Kassam & Mendes, 2013; Zahn-Waxler, Cole, Welsh, & Fox, 1995) and skin conductance (McRae, Taitano, & Lane, 2010). Unlike basic emotions, they often require self-reflection (Malti, 2016), social-cognitive skills (e.g., theory of mind; Gibbard, 1990; Malti & Keller, 2010), and the ability to balance self- and other-oriented goals, perspectives, and emotions (e.g., Killen, Mulvey, Richardson, Jampol, & Woodward, 2011). For example, in order to anticipate another person's perspective, a child needs to realize that they are different from the other person, such that each person has their own idiosyncratic desires, needs, and thoughts. This allows the child to separate their own feelings from the feelings experienced by others, which helps them orient to social cues. Due to this complexity, many moral emotions emerge later in child development than their more basic emotional counterparts (see Malti, 2016).

Taxonomy of Emotions in Contexts of Moral Conflict

Based on our theory, we have proposed a taxonomy of emotions in the context of moral conflicts by two dimensions, i.e., their valence and orientation (Fig. 2). Valence refers to whether an emotion arouses positive or negative feelings in the individual. Negatively valenced emotions occur when one acts contrary to their internalized norms (e.g., feeling guilt after inflicting harm; Malti et al., 2018). On the other hand, positively valenced emotions arise when the action aligns with the individual's moral standards (e.g., feeling pride after helping someone in need).

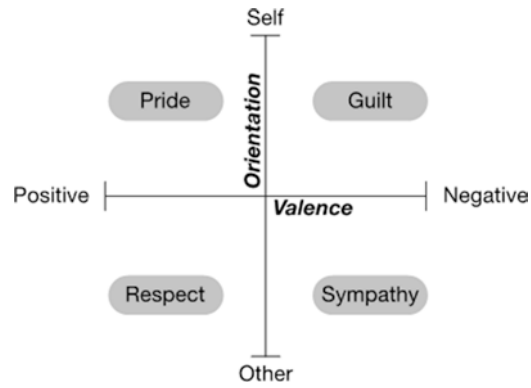

Fig. 2 Emotions in the context of moral conflict along the orientation-valence categorization (see Malti, 2016; Malti, Sette, & Dys, 2016; Malti, Dys, Colasante, & Peplak, 2018)

Orientation refers to whether the cause or focus of the emotion is directed toward the self or toward another. When an emotion is elicited in response to one's own actions, the emotion is considered self-conscious (i.e., guilt or pride), whereas, when the emotion is elicited by others' actions or states, the emotion is other-oriented (e.g., sympathy toward a peer who was harmed by another; Malti, 2016; Malti et al., 2018). By crossing the valence (negative versus positive) and orientation (self versus other), four distinct categories of emotions emerge: negative-self, negative-other, positive-self, and positive-other. The taxonomy is an organizational framework for distinguishing various emotional experiences that occur in multifaceted contexts of everyday moral conflicts. These distinct emotions may be experienced in isolation or in combination. For example, someone can feel sympathy for a person in distress that they are helping, and can simultaneously feel pride for having helped them.

To date, most of the developmental and clinical research on emotions in the context of conflict and morality focuses on negatively valenced emotions—i.e., guilt and sympathy. In addition to these two emotions, we review two prototypical positively valenced emotions: pride and respect.

Before delving further into a discussion of these emotions, we will propose our theoretical framework which summarizes the various components that are involved in moral emotional experiences. This framework provides a conceptual and empirical basis for how and why moral emotions are important for positive social-developmental outcomes.

Theoretical Framework: An Integrative Clinical-Developmental Approach

We have proposed that the study of moral emotions requires an integrative clinical-developmental approach (see Malti, 2016). Our multimethod approach provides a holistic understanding of moral emotions, which considers how biological, cognitive, behavioral, and contextual factors may interact in the emergence of these emotions across development (Fig. 3; see Malti, Colasante, Zuffianò, & de Bruine, 2015).

Biological factors, such as genetics and physiology, influence the capacity and expression of moral emotions over the course of development. Studies on twins have shown that genetics have a moderate to strong influence on adults' and adolescents' empathetic concern (Davis, Luce, & Kraus, 1994; Matthews, Batson, Horn, & Rosenman, 1981). One of the most commonly studied genes in relation to empathetic concern is the oxytocin receptor gene (OXTR). Oxytocin is a neurotransmitter that has been linked to the expression of socio-emotional responding across mammalian species (Sivaselvachandran, Acland, Abdallah, & Martin, 2018). Individuals carrying the GG allele of OXTR (rs53576) have been found to have higher dispositional empathetic concern and infer the emotional states of others with higher accuracies than their AA/AG allele counterparts (Rodrigues, Saslow, Garcia, John, & Keltner, 2009; Smith, Porges, Norman, Connelly, & Decety, 2014). Alternatively, having higher methylation of OXTR—which was related to lower circulating oxytocin blood levels—has been associated with higher levels of callous-unemotional traits among adolescent males (Dadds et al., 2014). Individuals with the OXTR GG allele also have shown increased skin conductance when viewing others in distress and in physical pain, suggesting that this gene is associated with physiological and emotional responding to social cues (Smith et al., 2014). The administration of oxytocin intranasally has been found to improve emotion recognition abilities in community samples and in adolescents with an autism spectrum disorder, who are characterized as having difficulties with demonstrating empathy (Gordon et al., 2016; Guastella et al., 2010; Shahrestani, Kemp, & Guastella, 2013). Being able to empathize with others requires the ability to correctly identify the emotions an individual is experiencing. One route that oxytocin may be improving empathetic abilities is through increased eye fixation, which provides information about what the individual is responding to and which emotions are being displayed

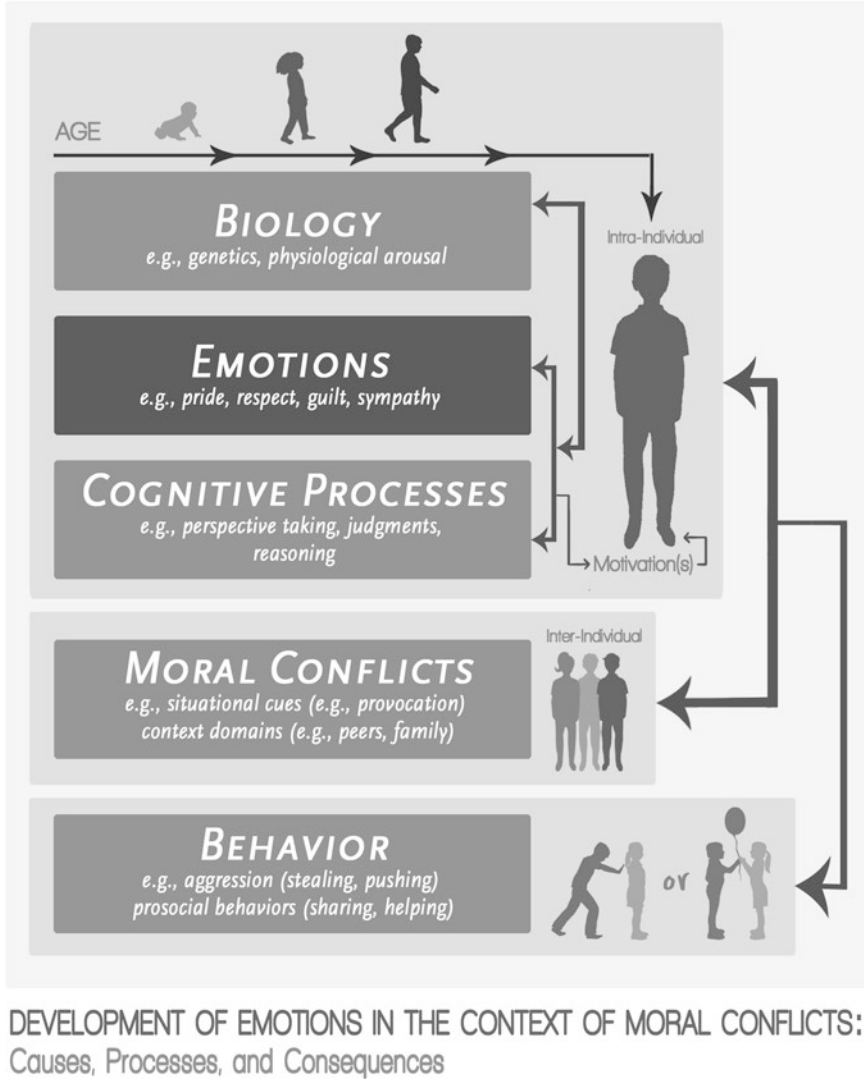

Fig. 3 An integrative clinical-developmental framework on the multiple dimensions (i.e., biological, cognitive, emotional, and contextual factors) that are involved in the genesis of emotions and (mal)adaptive behavioral outcomes in contexts of conflict and morality

(Guastella, Mitchell, & Dadds, 2008). OXTR is but one of many genes related to moral emotions and social behavioral outcomes (see Ebstein, Israel, Chew, Zhong, & Knafo, 2010; Raine, 2008). Together, these studies are an apt example of how epigenetic and genetic differences are related to social cue orienting and empathetic responding, suggesting genetics are a crucial factor in the development of moral emotions.

Physiological arousal (e.g., heart rate, vagal tone, skin conductance) has been considered a core mechanism influencing children's moral emotional experiences. For instance, having a low resting heart rate has been associated with antisociality in children and adults, such as higher rates of aggression and psychopathic traits (Portnoy & Farrington, 2015). Research assessing how physiological arousal relates to prosocial behaviors and moral emotions in children, however, has been mixed, where some have found positive linear relations, while others have found negative or no relation at all (Hastings & Miller,

2014). One possible explanation is that the relation is not linear, where those with moderate physiological arousal have the highest prosociality. In support of this theory, some recent studies have found a quadratic relation, where moderate vagal activity—measured using respiratory sinus arrhythmia (RSA)—was related to higher levels of prosocial behavior and empathetic concern in adults and children (i.e., inverted-U quadratic relation; Acland, Colasante, & Malti, in press; Kogan et al., 2014; Miller, Kahle, & Hastings, 2017). Overarousal may be related to higher personal distress when confronted with a needy other, which impairs the ability to focus on the distress of others. Whereas underarousal could result in lower stimulation from distress-related social cues, lowering motivation to help (Armstrong, Keller, Franklin, & Macmillan, 2009; Eisenberg, 2000). The relation between physiology, moral emotions, and behavior is complex, as it can be influenced by environment and age. For example, higher RSA reactivity in young children has been linked to lower externalizing behaviors, but only for children with low adversity environments (Obradović, Bush, Stamperdahl, Adler, & Boyce, 2010). Furthermore, feelings of guilt and sympathy can buffer the link between low physiological arousal and physical aggression for children from early to middle childhood, but not for those in early adolescence (Colasante & Malti, 2017). Thus, biological factors play an important role in influencing and interacting with moral emotions; however, further research is necessary to fully appreciate how and when they affect developmental outcomes.

Cognitive processes, such as perspective-taking, judgments, and reasoning, are also important components that influence children's moral emotional development. Young children have the ability to experience the basic components of moral emotions (e.g., concern for others; see Davidov, Zahn-Waxler, Roth-Hanania, & Knafo, 2013) and judge moral transgressions as wrong (Turiel, 1983). Even though moral emotions and judgments seem to be present within young children, they often have difficulty coordinating their emotions with their understanding of moral norms (see *happy victimizer phenomenon*; Malti & Keller, 2010; Malti & Ongley, 2014). For instance, a young child may know that it is wrong to steal from others yet they still may report feeling happy after stealing because they acquired something they wanted. With age, children spend more time with their peers (Rubin et al., 2015) and as a result, they further develop their cognitive skills, acquire perspective-taking skills, and become better at coordinating their affective and cognitive concerns within moral conflict situations (Malti & Ongley, 2014; Thompson & Lagattuta, 2006). Children are then able to understand that, although transgressions may result in the achievement of a personal goal and yield a positive short-term reward, moral transgressions have negative effects on others and their own self-image. This reflects an intraindividual conflict where children's selfish concerns and hedonistic desires compete with their other-oriented concerns and knowledge of moral standards. Typically as children age, values relating to the welfare of others are weighed more heavily within their intraconflicts, which may be related to the rewarding feelings of pride when engaging in other-oriented acts. For example, a child may have a sandwich for lunch, while their friend has no lunch. Eating the full sandwich would be rewarding on a short-term basis because they fulfilled a selfish desire; however, they also may experience guilt afterward when seeing that their friend is hungry. If they instead decide to give half their sandwich to the friend, that friend will likely respond with gratitude and happiness. This scenario would have a short-term cost of being less satiated, but they would also feel pride for making someone else happy, and in the long term, performing this morally desirable behavior may improve their self-image. The forces motivating prosocial behaviors, however, are not always clearly other-focused and may include more self-focused rewards such as expecting reciprocity (i.e., "the friend owes them one"), social approval, or desire to relieve the personal distress they are experiencing from watching someone else suffer (Eisenberg, Eggum, & Di Giunta, 2010). Emotional reactions to situations that involve intraconflicts become more automatized

over time, which can form scripts that are activated in similar contexts (Malti, 2016; Nucci & Gingo, 2011). Therefore, cognitive processes increase with age to enhance the experience of and coordination with moral emotions to affect social behavior outcomes.

We argue, however, that the link between cognition and emotion is bidirectional, where emotions also play a role within children's formation of principles, judgments, and reasoning (Malti & Ongley, 2014). For instance, within the first year of life, children experience empathic concern for a needy other, which is likely void of complex cognitive motivators. This affective arousal causes the child to feel bad when seeing others in need, which motivates prosocial helping behaviors and promotes subsequent development of the child's judgments surrounding principles of care. This would suggest that cognitive processes, such as moral judgments, affect the development and expression of moral emotions, but also vice versa, where moral emotions improve upon the development of morally relevant cognitive processes.

Our theoretical model also considers the dual role of moral emotions in the development of various behavioral outcomes. That is, moral emotions promote children's engagement in prosocial behaviors, while also discouraging their proclivity to behave aggressively. Positive links between empathy and prosocial behavior emerge by the second year of life, as toddlers often engage in helping or comforting behavior when they see an adult or peer in distress (Bischof-Köhler, 2012; Hoffman, 2000). This empathy-based prosocial behavior appears to increase beyond the second year of life into childhood and adolescence (e.g., Knafo, Zahn-Waxler, Van Hulle, Robinson, & Rhee, 2008). Empathy and sympathy have also been negatively related to aggressive behavior because other-oriented emotions help children shift focus from the self to the other, such as the victim (Eisenberg et al., 2010; van Noorden, Haselager, Cillessen, & Bukowski, 2015). Beyond empathy and sympathy, feelings of guilt in childhood also motivate prosocial behavior, such as apologizing (see Colasante, Zuffianò, Bae, & Malti, 2014; Malti, Ongley, et al., 2016), and can lead to the inhibition of concurrent and subsequent antisocial behaviors (Malti & Krettenauer, 2013; Stuewig et al., 2015). These links suggest that moral emotions are important motivators that promote other-oriented moral acts and deter self-serving hostile acts.

The final component considered in our integrative framework involves contextual features that influence the emergence and experience of moral emotions. There are many factors within a social interaction that increase or decrease the likelihood of experiencing certain moral emotions. Previous work has highlighted the importance of considering the relation between the target and observer when examining experiences of moral emotions. Sympathy, for instance, is more strongly felt when the victim is part of the in-group, such as a friend or kin (Burnstein, Crandall, & Kitayama, 1994; Korchmaros & Kenny, 2001). Further, situational cues such as cost of response (whether emotional or material) may also influence children's experiences of moral emotions. If a child perceives the costs of helping another to be manageable, sympathy is likely to be elicited; however, if the costs exceed the capabilities of the child, then experiences of distress rather than sympathy are more likely (Hoffman, 2000). Another situational cue that may influence children's experiences of moral emotions is provocation. For example, if a child shoves a peer and then that peer shoves them back, the child responding to the provocation may feel less guilt for committing the aggressive act than they would in other circumstances because of the potential contextual justifications (e.g., "He started it." or "I was just defending myself!"). Furthermore, past experiences with a particular target can change whether the child will feel immoral emotions (i.e., schadenfreude) or moral emotions (i.e., sympathy or guilt) toward a particular peer, affecting whether the resulting behavior will be prosocial or antisocial (Malti et al., 2018; Schulz, Rudolph, Tscharaktschiew, & Rudolph, 2013). Real life experiences require the consideration of all these factors and are weighed in conjunction when making decisions in complex social and moral conflict situations. Contextual factors create a special set of circum-

stances that interact with the developmental age, biological predispositions, cognitive processes, and moral emotions of each individual child to influence how they will respond to others.

In sum, our integrative theoretical framework accounts for developmental, biological, cognitive, and contextual factors in children's moral emotional experiences and behavioral outcomes. As mentioned previously, we focus on four prototypical moral emotions (guilt, sympathy, pride, respect) in contexts of intra- and interindividual conflicts in this chapter. In the following sections, we review and discuss the development of, pathways to, and behavioral correlates of these emotions.

Development of Emotions in Contexts of Moral Conflict

Guilt and Its Development

Guilt is a negatively valenced self-conscious emotion, in which an individual feels regret over wrongdoing (Malti, 2016). The experience of guilt following an individual's own wrongdoing is constructive as it promotes appropriate reparation of the damage done (Malti, 2016; see Colasante, Zuffianò, & Malti, 2016). While sometimes equated with shame, guilt differs from shame in that shame involves negative emotions that are attributed to the self as a whole, while guilt involves negative feelings attributed to a specific behavior (Malti, 2016; Orth, Robins, & Soto, 2010). For instance, when there is an internal conflict between an individual's selfish and other-oriented concerns (i.e., an intraindividual conflict; see Fig. 1), committing the selfish act would produce guilt if the person felt negatively about the *action*'s effect on the other person, thus motivating reparative behaviors. If the action, however, made the actor feel like a bad *person*, then they may feel shame and avoid attending to the consequences of their action in order to avoid feeling worse about themselves. Of course, these emotions are not exclusive to one another; however, they have been shown to motivate different behaviors (i.e., prosociality vs. withdrawal; Covert, Tangney, Maddux, & Heleno, 2003; Stuewig & McCloskey, 2005).

Internalized principles and ideals, such as valuing the welfare of others, can induce guilt when transgressed. The strength of these principles and ideals, however, may vary based on contextual factors, such as situation severity or cultural norms and values. For example, if a culture emphasizes putting others' needs first, individuals in that society may experience more guilt when acting selfishly in social conflicts, which would motivate higher levels of other-oriented behaviors (Bedford & Hwang, 2003). Although guilt can promote prosocial behaviors, if an individual experiences emotional overreactions to wrongdoings, it may become neurotic guilt. Neurotic guilt may occur in and across contexts and is often thought to be maladaptive, inducing depression, anxiety, and other types of psychopathology (Malti, 2016).

Expressions of guilt typically do not fully emerge until 6 to 7 years of age because of the sophisticated cognitive processes involved in its occurance (Kim, Thibodeau, & Jorgensen, 2011). Precursors to guilt, however, have been observed as early as 2 years of age (e.g., distress, gaze aversion, and bodily tension) after damaging a valuable object and appear to be longitudinally stable over the course of early childhood, as measured between the ages of 22 and 45 months (see Kochanska, Gross, Lin, & Nichols, 2002). This suggests that even young children experience guilt-related feelings, such as distress following wrongdoing.

By mid-childhood, children develop a more complete concept of guilt (Malti, 2016). There is evidence that the majority of young children report feeling happy after imagining being a transgressor (the happy victimizer phenomenon); however, once children develop self-reflection and perspective-taking skills, they increasingly begin to recognize the negative consequences of transgressions on others. By middle childhood, children are more likely to report negative feelings following transgressions (Keller, Lourenço, Malti, & Saalbach, 2003; Malti & Ongley, 2014).

Later in development, between the ages of 12 and 20, guilt and related emotions are one of the strongest predictors for selecting a moral choice in antisocial behavior contexts (e.g., choosing not to steal or cheat; Krettenauer, Jia, & Mosleh, 2011). Thus, guilt becomes increasingly important in navigating multifaceted moral conflicts over the course of development.

Sympathy and Its Development

Sympathy is a negatively valenced other-oriented emotional response, which stems from the apprehension or comprehension of another person's emotional state or condition. It consists of feeling sorrow or concern for the needy other (Eisenberg, 2000; Eisenberg, Spinrad, & Morris, 2014). In contrast to empathy, sympathy does not involve sharing another's emotional state (Eisenberg, 2000). Unlike sympathy, which is other-oriented, empathy can be self-centered if it turns into personal distress (i.e., an intense empathic response), and may result in self-centered action (e.g., fleeing). For this reason, we conceptualize empathy as an emotional *capacity* that serves as a developmental precursor to sympathy (see Malti, Sette, & Dys, 2016).

Sympathy begins to manifest early on in development, with some researchers arguing that precursors of sympathy are present in the first year of life (Davidov et al., 2013). Infants have been found to demonstrate rudimentary forms of empathic responses, otherwise known as "emotional contagion", such as reactively crying in response to hearing other infants crying (Dondi, Simion, & Caltran, 1999; Hoffman, 2000; Roth-Hanania, Davidov, & Zahn-Waxler, 2011). Between the first and second year of life, children begin to show differentiation between the self and others, and with the development of this differentiation, they begin to show more concern for harmed or distressed others (Eisenberg, Spinrad, & Knafo-Noam, 2015; Rhee et al., 2013; Zahn-Waxler, Radke-Yarrow, Wagner, & Chapman, 1992; Zahn-Waxler, Schiro, Robinson, Emde, & Schmitz, 2001). Between the ages of 18- and 25-months, infants show increased concern and prosocial behavior when a person has been harmed, even if they do not express any negative emotions (e.g., anger or sadness), suggesting that even at this early age, they have developed some affective perspective-taking skills (Vaish, Carpenter, & Tomasello, 2009).

During the preschool years, sympathetic responding increases, with older preschool children demonstrating more prosocial responses to others' distress than younger preschool children (Eisenberg et al., 2014; Phinney, Feshbach, & Farver, 1986). Children's sympathy further increases from early to late childhood (Colasante et al., 2016; Colasante, Zuffianò, & Malti, 2015; Ongley & Malti, 2014). For instance, Kienbaum (2014) found that children's sympathy increased between the ages of 5 and 7 years, with a larger upsurge in sympathy occurring between the ages of 5 and 6 years. This differential change may be due to the transition from early childcare to elementary school, as this new social environment may expand children's opportunities to engage in social interactions and conflicts involving others in distress. By middle childhood, most children have acquired perspective-taking skills, such as understanding that others have thoughts and feelings that are different from their own, which likely enhances their awareness of how harm negatively affects others (Malti et al., 2018).

Pride and Its Development

Here we focus on expressions of pride in moral contexts. Like guilt, pride is a self-conscious emotion. Unlike guilt, it is positive in valence. Feelings of pride occur when an individual behaves in accordance with norms concerning others' welfare (Ongley & Malti, 2014; Tangney et al., 2007). For instance, an individual will likely feel proud after helping someone because this is in line with moral standards of care behaviors. Similar to the distinction between guilt and shame, pride may take two forms that vary based on whether they are behavior- or person-focused: authentic pride versus hubristic pride. Authentic

pride (related to genuine self-esteem) is experienced as a result of the specific situation or behavior, and occurs when there is a positive outcome for another (e.g., "I am proud because I did a good thing"). Comparatively, hubristic pride (related to narcissism) involves positive feelings that are attributed to an individual's global self-concept (e.g., "I am proud because I am a good person"; Tracy & Robins, 2007). Here, we focus on authentic pride.

To date, only a handful of studies on the development of authentic pride have been conducted, and much of the existing research focuses on its precursor (i.e., happiness). For instance, one study found that when 2-year-olds completed a goal or helped someone else complete a goal, they experienced increases in happiness, displayed through more upright postures, akin to expressions of pride (Hepach, Vaish, & Tomasello, 2017). Further, children have been found to experience more happiness when they give treats to a puppet than when they receive treats, showcasing early experiences of pride following prosocial behavior (Aknin, Hamlin, & Dunn, 2012).

Pride appears to increase from early to middle childhood. For instance, when comparing 8-year-olds to 4-year-olds, 8-year-olds rated themselves as experiencing higher levels of positively valenced emotions, such as pride, when they imagined that they helped or included a peer in a social activity (Ongley & Malti, 2014). During the adolescent years, pride is an important motive in prosocial decision-making, such as donating or helping someone in need. Overall adolescents and young adults between the ages of 11 and 19 report more pride in prosocial contexts (e.g., helping another person) compared to temptation contexts (e.g., breaking a moral rule for personal profit; Krettenauer & Johnston, 2011). Furthermore, 18-year-olds are more likely to report feeling good after making a moral choice compared to 15-year-olds (Malti, Keller, & Buchmann, 2013). These studies suggest that it is important to examine the development of pride and how it affects prosocial and aggressive behaviors, particularly early on when children are not yet able to verbally express their emotional experiences.

Respect and Its Development

Respect, a positively valenced other-oriented emotion, occurs when an individual experiences positive feelings of admiration for another's moral virtues or behaviors (Peplak & Malti, 2017; Zuffiano, Colasante, Peplak, & Malti, 2015). It has been conceptualized as a motive for prosocial behaviors because it promotes the emulation of the respected behaviors or characteristics (Peplak & Malti, 2017). For example, one may experience high degrees of respect for individuals who spend their weekends doing volunteer work, and as a result, may themselves sign up to volunteer because they want to engage in the respected behavior.

According to Piaget (1932/1965), there are two forms of respect: unilateral and mutual respect. Unilateral respect is associated with the young children's obedience of authority figures that stems from fear of punishment (Malti, Peplak, Myatt, & Zhang, 2019). Mutual respect, also known as reciprocal respect, is rooted in equality and theorized to emerge in middle childhood. Reciprocal respect results from children's understanding of fairness and the golden rule, which is to treat others the way you want to be treated (see Kant, 1797/1996).

Contemporary empirical work suggests that even young children have a concept of respect that is grounded in principles of fairness, reciprocity, and welfare of others. Malti and colleagues (2019) examined conceptions of respect in children from 5 to 15 years of age using open-ended interview techniques. Children of all ages frequently referred to fairness, prosociality, and kindness concepts when defining respect and increasingly conceptualized respect in terms of fairness as they age. Other research has also shown that children in early childhood do not conceptualize respect as being driven by fear, but instead understand respect to revolve around interpersonal obligations and prosocial norms (e.g., being nice; Shwalb & Shwalb, 2006). While Piaget's (1932/1965) theorizing is an important stepping stone in the study of moral respect, research suggests that children more commonly understand respect in terms of reciprocity and equality than in unilateral fear-motivated forms.

Pathways to Moral Emotions: Temperament, Socialization, and Gender

A substantial amount of research has investigated the processes that underlie the development of sympathy, followed by guilt, whereas very limited, if any, has looked into how pride and respect develop across childhood and adolescence (e.g., Eisenberg et al., 1997; Kochanska, 1993; see Eisenberg, 2000). Hereby, we briefly review the literature on factors that contribute to individual differences in the development of guilt and sympathy with a focus on two key processes, namely, temperament and parental socialization. We also reviewed the literature on gender differences in the development of moral emotions.

Temperament

Temperament measures biologically based individual differences in reactivity and regulatory capacities that emerge as early as the first few months after birth (Rothbart, Ahadi, & Hershey, 1994). Two key aspects of temperament—proneness to negative emotions and regulatory capacities—have been theorized to be important temperamental underpinnings of the development of guilt and sympathy (Eisenberg, 2000; Kochanska, 1993). Based on Kochanska (1993), the tendency to experience affective discomfort over wrongdoing (e.g., fearful temperament) and the ability to inhibit impulsive and immoral behaviors (e.g., inhibitory control) are key indicators of guilt. Similarly, Eisenberg (2000) has argued that children who are prone to negative emotional experiences, particularly sadness and fear (as opposed to anger), are also prone to feel sympathy toward others in distress. However, extremely high levels of negative emotionality may expose children to overwhelmed negative affect and thus lead to self-centered personal distress, rather than other-oriented sympathy. Therefore, the capacity to regulate one's over-aroused negative affect may be particularly important in leading to sympathy rather than personal distress. Thus, both negative emotionality and dispositional regulatory capacity are hypothesized to be important pathways to the development of guilt and sympathy.

Empirical work has supported a positive link of both components of temperament with guilt in toddlerhood and early childhood with some nuances (e.g., Kochanska, 1997; Rothbart et al., 1994). For example, in Kochanska's longitudinal study, children who were more temperamentally fearful based on laboratory observations in fear-inducing paradigms displayed more signs of guilt (e.g., gaze aversion, negative affect) when they were led to believe that they damaged an object at ages of 22, 33, and 45 months (Kochanska et al., 2002). In another longitudinal study, the role of fearful temperament in infancy in children's behavioral and physiological (heart rate, skin conductance level) reactions in a guilt-inducing paradigm at age 3 were examined (Baker, Baibazarova, Ktistaki, Shelton, & Van Goozen, 2012). Neither observed nor mother-reported fear in infancy predicted guilt reactions at age 3, although physiological reactions in the fear-inducing paradigm in infancy were related to physiological reactions in the guilt-inducing paradigm at age 3, suggesting some common physiological mechanisms across fear and guilt. In the domain of temperamental regulatory capacities, effortful or inhibitory control has been positively associated with guilt. For example, effortful control has been found to predict affective discomfort over wrongdoing among children in early childhood in two studies, using both parents' report and observational data (sometimes only for girls; Kochanska et al., 1994; Kochanska, Barry, Jimenez, Hollatz, & Woodard, 2009). The positive association between emotion regulation and guilt was also reported in adolescents while controlling for negative emotionality (which was unrelated to guilt; Murphy, Laible, Augustine, & Robeson, 2015). Taken together, there is evidence to support Kochanska's two-component model of guilt and its temperamental underpinnings. Both temperamental fearfulness and regulation contribute to the development of guilt in the early years of life, although their unique and interactive effects on guilt are less clear. Also, most of the work has focused on early childhood

years, whereas whether the association of temperament and guilt persist through adolescence still requires more research.

In contrast, empirical findings on how components of temperament relate to sympathy are relatively mixed, especially for negative emotionality (see Eisenberg, 2000). Whereas some researchers reported a positive relation between negative emotionality and sympathy (e.g., Rothbart et al., 1994), other researchers found a negative or null relation between the two (e.g., Eisenberg et al., 1996). For example, in Eisenberg's longitudinal work, parent- and teacher-reported negative emotionality was either negatively or not significantly related to teacher- and child-reported dispositional sympathy during early to mid-childhood years (e.g., Eisenberg et al., 1997). Further investigation suggested that the type of negative emotions and the assessment of sympathy, in part, explain the mixed results. For example, maternal reports of overall negative affect were unrelated to dispositional empathy at 7 years of age, whereas sadness and fear, rather than anger, were positively correlated with dispositional empathy (Rothbart et al., 1994). However, this was not replicated with observed sympathy (indicated by hypothesis testing and expressed concern) in a laboratory task at 18, 30, and 42 months of age (i.e., mother- and caregiver-reported dispositional sadness was unrelated to observed sympathy; Edwards et al., 2015).

While it is unclear how negative emotionality relates to sympathy, the relation between temperamental regulatory capacity (e.g., effortful control) and sympathy is relatively clearer. Consistent with the theory, children with higher temperamental regulatory capacity tend to display higher levels of sympathy (e.g., Rothbart et al., 1994). In Eisenberg's longitudinal study, temperamental regulation, indicated by attentional control, impulsivity and inhibitory control, global self-control, and vagal tone, was found to be positively related to teacher- and child-reported dispositional sympathy across early childhood years (e.g., Eisenberg et al., 1996, 1997). Moreover, earlier temperamental regulation has also predicted sympathy across time. For example, effortful control at 54 months (a composite of mother, teacher, and observer report) was positively related to adult-reported dispositional sympathy at 72 months, even after controlling for earlier sympathy (Taylor, Eisenberg, & Spinrad, 2015). Beyond early childhood years, effortful control in the early school years also predicted adult-reported dispositional sympathy during early adolescence (Eisenberg et al., 2007). In addition, there is emerging evidence that children who were temperamentally prone to inhibition or intense emotions were more likely to develop sympathy when they have higher levels of regulation (e.g., effortful control; Eisenberg et al., 1997; Stifter, Cipriano, Conway, & Kelleher, 2009). Taken together, temperamental regulatory capacity seems to be particularly important in the development of sympathy, at least in the early childhood years, whereas how negative emotionality contributes to sympathy may be modulated by children's capacity to regulate their emotions and behaviors.

Socialization

How we are raised holds heavy sway over our developmental outcomes, and thus the parenting practices and styles we experience even at very early stages can influence the way we express moral emotions throughout our lives. Unfortunately, there is limited research regarding how parenting affects children's development of guilt. Some of the work that does exist suggests that parenting behaviors can have long-term impacts on an individual's feelings of both guilt and shame. For example, in emerging adults between the ages of 18 and 29, having experienced positive parenting techniques, such as high parental responsivity, and assurances of protection as a child, is related to expressions of guilt rather than the similar but less adaptive emotion of shame, which was associated with negative parenting behaviors (Mintz, Etengoff, & Grysman, 2017). Additionally, parenting seems to impact expressions of guilt in young children who have poor inhibition. Children between the ages of 3 and 5 who are behaviorally uninhibited, and lack consistent discipline seem to have lower

parent-reported levels of guilt, than children who are uninhibited but experience high levels of authoritarian parenting (Cornell & Frick, 2007).

While there has only been a cursory exploration of how parenting affects the development and expression of guilt, the link between parenting style and sympathy seems to be better established. Multiple longitudinal studies have demonstrated that parenting styles in early childhood affect children's expressions of sympathy in middle childhood and beyond. For instance, children who experience parenting with high warmth, sensitivity, and authoritative control at 3.5 years of age express higher effortful control at 4 years of age, which in turn promotes higher levels of sympathy at age 6 and 7 (Taylor et al., 2015). Moreover, children who maintain high and stable levels of sympathy across middle childhood report having more supportive parenting, with high warmth and responsiveness, than children who have average or low levels of sympathy (Malti, Eisenberg, Kim, & Buchmann, 2013). Even in adolescence, the quality of parenting seems to continue to guide an individual's sympathetic responsivity; however, maternal parenting style seems to be more important at this age than paternal parenting style. High maternal warmth, and support, and low maternal rigid control have been related to higher sympathy in middle and high school students, while all paternal parenting variables had no significant effect (Carlo, Mestre, Samper, Tur, & Armenta, 2011; Laible & Carlo, 2004). Further, a study has also shown that specific parenting practices, such as talking about prosocial behavior, offering social rewards for good deeds such as praise and gratitude, and providing hands-on learning experiences, can promote sympathy in adolescents (Carlo, McGinley, Hayes, Batenhorst, & Wilkinson, 2007).

Finally, there is a lack of research on positively valenced moral emotions, and hence we know very little about how parenting styles can impact the development and expression of pride and respect. We might expect to see similar patterns to that of guilt and sympathy, where positive parenting styles and practices promote higher levels of pride and respect, while negative parenting behaviors may predict fewer expressions of these emotions. However, future work is needed to investigate how, and what types of, parenting practices, may motivate the development of positively valenced moral emotions.

Gender

Emotional experiences and displays are often perceived to differ across gender, with girls and women being seen as more emotional and emotionally expressive compared to boys and men (Plant, Hyde, Keltner, & Devine, 2000). However, gender differentiation in children's displays of moral emotions may not be so clear cut, and gender may be more strongly linked to the experience of some moral emotions over others. Gender, for instance, has been shown to be related to the development of children's feelings of the negatively valenced moral emotion of guilt. As early as 2 years of age, girls seem to feel more guilt over their wrongdoings compared to boys of the same age. In one study by Kochanska and colleagues (2002), when 2- and 3-year-olds were led to believe they had damaged a valuable good, girls displayed more guilty behaviors, such as avoiding gaze and bodily tension, and had higher negative affect than boys. Similarly, in late childhood gender continues to distinguish the experience of guilt. For example, 10- to 12-year-old girls anticipated more feelings of guilt to hypothetical aggressive episodes in which they were the aggressor compared to boys (Roos, Salmivalli, & Hodges, 2011). It has been suggested that these differences in guilt expression and development in girls and boys, and eventually men and women, may be due to gender role socialization and gender-stereotyping in childhood (Else-Quest, Higgins, Allison, & Morton, 2012). Young girls are often expected to be more understanding and better able to anticipate the negative consequences of their actions compared to boys (Ferguson, Stegge, Miller, & Olsen, 1999), which may in turn lead to more and stronger expressions of guilt.

Unlike guilt, it remains unclear whether gender differences exist in the development and

expression of sympathy. There is some research indicating that by middle childhood and into adolescence, girls tend to rate themselves, and are rated by others, such as parents or teachers, as being higher in sympathy than their male peers (Daniel, Dys, Buchmann, & Malti, 2016; Eisenberg et al., 2005, 2007, 2014; Hastings, Zahn-Waxler, Robinson, Usher, & Bridges, 2000; Ongley & Malti, 2014). This is in line with meta-analytic work that has found that girls express more negative internalizing emotions such as sympathy, shame, and sadness (Chaplin & Aldao, 2013). However, there is also evidence suggesting that girls and boys have similar experiences of sympathy. For example, Kienbaum's (2014) longitudinal study which followed children's development of sympathy from age 5 to 7 using observational, self-report, and other-reported measures, found no gender differences in expressions of sympathy. Even older girls and boys (e.g., ages 7 to 12) demonstrate similar feelings of self-reported sympathy toward targets of peer aggression (MacEvoy & Leff, 2012). One possible explanation for these dissimilar patterns of findings is the methodologies employed by these studies. It has been suggested that self-report measures of sympathy may invoke gender stereotypical responses (Eisenberg & Lennon, 1983), as girls are often expected to have better perspective-taking skills and be more understanding than boys (Ferguson et al., 1999). This is supported by evidence that when using other measures, such as physiological measures, girls do not seem to be significantly higher in sympathy than boys (Eisenberg et al., 2014). Further work with adolescents has also found that gender-role orientation, rather than biological sex, may be a better indicator of other-orientations such as sympathy. In one such study by Eisenberg, Zhou, and Koller (2001), having a feminine gender-role orientation where one is more tender, yielding, and understanding predicted higher levels of sympathy among 13- and 16-year-old adolescents.

The research regarding gender and positively valenced moral emotions such as pride and respect remains understudied. Although there is evidence that expressions of nonmoral pride differ between adolescent girls and boys, where girls express pride more intensely than boys (Webb et al., 2016), we cannot be sure if this pattern would extend to expressions of moral pride. Similarly, there does not seem to be any existing research which delves into the differences of moral respect development across gender.

To summarize, we briefly reviewed the literature on temperamental and socialization processes as well as gender differences in the development of guilt and sympathy, due to a lack of research on positively valenced moral emotions. Based on the literature, both temperament (e.g., proneness to negative emotions and regulation) and parental socialization (e.g., warmth and responsiveness) contribute to individual differences in the development of guilt and sympathy, especially in early childhood. Gender differences in guilt and sympathy remain inconclusive with some evidence indicating girls display more moral emotions than boys. Looking into the future, research is needed to investigate individual and environmental pathways in the development of pride and respect, as well as common and unique processes of the development of different moral emotions.

Emotion-Behavior Links in Contexts of Moral Conflicts

Emotions in the context of moral conflicts are theorized to be the main driving motivational forces behind adaptive and maladaptive social behaviors (e.g., Arsenio, 2014; Hoffman, 2000; Malti, 2016). Prosocial behaviors are considered adaptive for functioning in large social societies and are defined as behaviors intended to benefit others, such as sharing, helping, and comforting (Eisenberg et al., 2015). Aggressive behaviors are considered maladaptive in most contexts as they are intended to harm others physically or psychologically, which often worsens social outcomes (Krahé, 2013). Children experience various other-oriented and self-conscious emotions when conforming to or violating interpersonal norms. As they age, children become increasingly skillful at anticipating how their actions will affect others, as well as their own self-image, motivat-

ing them to engage in less aggressive and more prosocial behaviors (Arsenio, 2014). For example, a child may experience pride after sharing with a peer. Next time there is an opportunity to share, the child may engage in sharing again because of the rewarding feelings they felt previously when sharing. Variations in individuals' abilities to anticipate and experience moral emotions are hypothesized to explain, at least in part, the differing levels of prosocial and aggressive behaviors across individuals. In the following sections, we provide an overview of the essential research on how emotions in the context of moral conflicts link to aggressive and prosocial behaviors across childhood and adolescence.

Guilt-Behavior Links

Guilt, when experienced as negative feelings toward one's failure to follow moral standards, can be constructive and motivate socially adaptive behaviors, such as reparative behaviors (Malti, 2016). Similarly, because feelings of guilt are unpleasant, children may also learn to avoid aggressive behaviors that will elicit such feelings, such as inhibiting hitting another child in order to get a toy from them. Therefore, guilt is theorized to be negatively related to aggression and positively related to prosocial behavior.

Guilt and Aggressive Behavior

Guilt and its precursors begin to influence behavior early on in development. Children as young as 22, 33, and 45 months of age who display more guilt-related reactions (e.g., avoid gaze, negative affect) when they believe that they have damaged a valuable object are less likely to violate rules at 56-months-old, such as cheating in a throwing game (Kochanska et al., 2002). These toddlers were also rated by parents and teachers as having fewer disruptive conduct problems at 56, 67, and 73 months old (Kochanska et al., 2009). In early to middle childhood, Dinolfo and Malti (2013) found that 4- to 8-year-olds who experienced lower levels of situational guilt in hypothetical transgressions also showed higher levels of oppositional defiant disorder symptoms. Similarly, lower guilt responses to hypothetical scenarios was linked to aggressive and antisocial behaviors in young adolescents (Menesini et al., 2003; Menesini & Camodeca, 2008; Olthof, 2012), as well as traditional and cyber bullying in 12- to 19-year-olds (Perren & Gutzwiller-Helfenfinger, 2012). Further confirming these findings, a meta-analytic review of 42 studies that assessed all developmental periods found that having increased negative feelings (such as guilt) after situational, hypothetical moral transgressions was moderately associated with lower levels of antisocial behavior ($d = 0.39$; Malti & Krettenauer, 2013). This relation was also found when examining links between dispositional guilt and antisocial behavior, where adolescents who had higher dispositional guilt (or guilt-proneness) were less likely to display aggression and bullying behavior, concurrently (e.g., Roberts, Strayer, & Denham, 2014; Roos, Hodges, & Salmivalli, 2014) and longitudinally (Stuewig et al., 2015). Taken together, these studies would indicate that from early childhood into adulthood, increased guilt responding is related to lower antisocial behaviors.

While experiencing guilt in moral conflict situations has been linked to decreases in children's and adolescents' aggressive acts, guilt has also been found to serve as a protective factor against aggression-related risks. For example, low resting heart rate (HR) is a well-replicated biological risk factor for childhood aggression (Lorber, 2004; Ortiz & Raine, 2004; Portnoy & Farrington, 2015). Recently, research has pointed to the role of guilt responses in moderating this link; that is, when children experience medium to high intensities of guilt, the relation between low HR and physical aggression dissipates (see Colasante & Malti, 2017). Similarly, anger has long been considered a precursor of aggression; however, when children experience high intensities of guilt in hypothetical moral conflict situations, the link between anger (both situational and dispositional) and aggression is nonsignificant (Colasante et al., 2015, 2016). Together, there is ample evidence to support the protective role of guilt, directly or indirectly, in decreasing aggression across childhood and adolescence.

Guilt and Prosocial Behavior

Guilt-related precursors influence the expression of prosocial behaviors from early on. For instance, toddlers in an experimental task who showed more guilt-like responses, such as trying to repair an adult's toy they thought they broke, were more likely to help an adult in emotional distress in a follow-up task than toddlers who showed shame-like responses (e.g., gaze aversion and bodily avoidance) in the same task (Drummond, Hammond, Satlof-Bedrick, Waugh, & Brownell, 2016). Similarly at 3 years of age, children who harmed another (e.g., by accidentally breaking their toy) were found to show greater reparative behavior, such as trying to fix the damaged toy, than children who had not caused harm (Vaish, Carpenter, & Tomasello, 2016). According to a meta-analytic review, situational guilt is weak-to-moderately associated with prosocial behavior in children and adolescents (d = 0.26; Malti & Krettenauer, 2013). This association has been found concurrently and longitudinally in fifth and sixth graders (Roos et al., 2014), suggesting that children who feel guilt when causing harm to others are likely to engage in behavior that promotes positive peer interactions, as guilt may highlight that harmful behaviors feel "bad" and prosocial behavior feels "good."

In addition to direct associations with prosocial behavior, there is also evidence that guilt may compensate for the absence of other important moral emotions, such as sympathy, in promoting prosocial behaviors (Malti, Gummerum, Keller, & Buchmann, 2009; Ongley & Malti, 2014). In a three-wave longitudinal study with 175 6-year-old children, high levels of guilt were related to initial levels of, and increases in cooperation regardless of children's levels of sympathy (Malti, Ongley, et al., 2016). This suggests that guilt plays an important role in promoting children's prosocial behavior, even when children may not feel very much concern for others (Malti & Krettenauer, 2013).

Sympathy-Behavior Links

Feeling concern for others is expected to motivate individuals to reduce others' distress by engaging in behaviors such as comforting and helping. In the same vein, concern for others is theorized to discourage acts that may cause others harm. This is because sympathy (i.e., feelings of concern for others) orients individuals to the distress of others and ignites a desire to alleviate, rather than exacerbate, others' suffering (Eisenberg et al., 2014). As such, sympathy is considered an important emotion underlying prosocial behavior and a similarly important deterrent of antisocial behavior (e.g., Eisenberg et al., 2014).

Sympathy and Aggressive Behavior

A considerable amount of work has investigated the relation between sympathy and aggressive behavior in children and adolescents. Surprisingly, however, results have not been entirely consistent. A systematic review of 17 studies reported that the relation of affective (in contrast to cognitive) empathy/sympathy with aggression has been mixed among children, but relatively consistent in adolescents (i.e., higher sympathy relates to lower aggression; Lovett & Sheffield, 2007). In a recent review, Eisenberg et al. (2014) concluded that there is likely a negative relation between empathy-related responding (i.e., empathy, sympathy, and personal distress) and aggressive behavior, but it may not emerge consistently in children until about 6 years of age. Another review of 40 studies also supported the negative, albeit moderate, link between cognitive and affective empathy and bullying behavior among children and adolescents (van Noorden et al., 2015). Recently, the codevelopment of sympathy and overt aggression from the ages of 6 to 12 was examined in a large, representative sample of 1273 children (Zuffianò, Colasante, Buchmann, & Malti, 2017). Results revealed that children with higher caregiver- and teacher-rated sympathy were lower on overt aggression at each assessment time (i.e., ages 6, 9, and 12 years). Moreover, sympathy and aggression demonstrated a codevelopmental pattern, such that children who showed steeper increases in sympathy were also likely to have a steeper deceasing trajectory of overt aggression.

Similar to guilt, sympathy functions as a protective factor against risks associated with aggression in childhood and adolescence (e.g.,

low heart rate, high anger levels). For example, in 8-year-old children with high levels of sympathy, anger and resting heart rate were not associated with aggression, suggesting that high sympathy can attenuate the effects of low physiological arousal and angry dispositions in fostering aggression among children (Colasante et al., 2015, 2016; Colasante & Malti, 2017).

Sympathy and Prosocial Behavior

Some researchers have argued that children start to show concern for others by the first year of life (Davidov et al., 2013), and such feelings of concern serve as a basis for the motivation of early displays of prosocial behavior (e.g., Knafo et al., 2008; Roth-Hanania et al., 2011; Vaish et al., 2009). Indeed, this relation continues to flourish into middle childhood and beyond (e.g., Malti et al., 2009). In a recent study following children from 6- to 12-years-old, child- and teacher-rated sympathy was positively associated with subtypes of prosocial behavior, including helping, cooperation, and sharing across age groups (Malti, Ongley, et al., 2016). Sympathy has also been related to prosocial behavior cross-culturally (e.g., in Germany, Israel, Indonesia, and Malaysia; Trommsdorff, Friedlmeier, & Mayer, 2007). The positive relations between sympathy and prosocial behavior, however, were stronger in children from Western cultures (Germany and Israel), compared to that in children from South-Asian cultures (Indonesia and Malaysia), highlighting the importance of considering contextual processes in examining these links.

Beyond childhood, sympathy has been consistently and positively linked to prosocial behavior during adolescence (e.g., Carlo et al., 2007; Eisenberg, Miller, Shell, McNalley, & Shea, 1991). For instance, in a 5-year longitudinal study following adolescents from age 12 to 16, sympathy was positively associated with prosocial behavior toward strangers at each assessment point (Carlo, Padilla-Walker, & Nielson, 2015). Moreover, there was evidence for bidirectional longitudinal relations between sympathy and prosocial behavior, such that earlier sympathy positively predicted increased prosocial behavior across 1 year, and vice versa. Taken together, sympathy is a robust moral emotion that is linked to prosocial behaviors throughout childhood and adolescence (e.g., see Eisenberg et al., 2014).

Pride-Behavior Links

A distinction between authentic pride ("feeling good about what I did") from hubristic pride ("feeling good about who I am") is important when studying pride, especially in relation to social behaviors. While authentic pride is likely to motivate adaptive social behaviors, hubristic pride may in fact lead to maladaptive behaviors (Wubben, De Cremer, & van Dijk, 2012). For example, when pride is experienced as a consequence of a prosocial act that is in line with one's moral standard, it may serve as a reward that motivates subsequent prosocial behaviors. However, when individuals feel proud of themselves, behaviors that are not favorable may be used as a way to maintain their self-image when it is challenged. Therefore, authentic pride is expected to relate negatively to aggressive behavior and positively to prosocial behavior, while the opposite is expected for hubristic pride.

Pride and Aggressive Behavior

The literature on links between pride and aggression is scant. To date, Krettenauer and Casey (2015) examined both types of pride in relation to moral identity, moral motivation, and social behaviors in high school and first-year undergraduate students. They found that self-reported authentic pride was negatively related to antisocial behavior, whereas hubristic pride was positively related to antisocial behavior. The results suggest that feeling proud over one's actions, but not necessarily about themselves, may protect against antisocial behavior, although more research is needed to establish this link.

Pride and Prosocial Behavior

Although research on developmental links between pride and prosocial behaviors is still developing, there is emerging evidence suggesting that pride strengthens behaviors which generate it (see Boezeman & Ellemers, 2008; Hart & Matsuba, 2007). For example, students from grade 7 to first-year university who reported

higher levels of positive, self-oriented emotions in hypothetical vignettes (e.g., "feel good about oneself for helping or not stealing") were more likely to make a prosocial choice in this context (Krettenauer et al., 2011). Additionally, authentic pride was positively related to self-reported prosocial behavior in tenth graders and first-year university students (Krettenauer & Casey, 2015). Further, 10- and 11-year-old children who experienced pride after writing letters to sick children in developing countries were more likely to subsequently sign up to spend more school breaks writing letters to the government requesting help for victims of flooding in the Philippines compared to children who experienced less pride (Etxebarria, Ortiz, Apodaca, Pascual, & Conejero, 2015). In contrast, Ongley and Malti (2014) did not find a significant relation between the anticipation of positive emotions (i.e., proud, good, or happy) after a prosocial action and costly sharing behavior in a dictator game in a sample of 4-, 8-, and 12-year-old children. Taken together, the link between pride and prosocial behaviors may be more salient in adolescence than in childhood and may depend on the type (e.g., high cost vs. low cost) of prosocial behavior investigated.

Respect-Behavior Links

Feelings of admiration for others who behave in line with their moral standards and respect for morally relevant actions are thought to encourage individuals to behave in a similar way. Thus, although rarely examined, respect is believed to motivate socially adaptive behaviors, such as helping, and inhibit socially maladaptive behaviors, such as harming (Malti et al., 2018).

Respect and Aggressive Behavior

To date, there has been limited empirical work on the links between respect and aggression among children and adolescents. In a recent study with a sample of ethnically diverse 5- to 10-year-old children, respect was examined in two (im)moral contexts: one depicting fairness behavior (sharing an equal amount of lollipops) and the other depicting aggression (pushing classmates in the school yard) (Peplak & Malti, 2017). Respect for a fair protagonist was related to lower levels of overt and proactive aggression, but unrelated to reactive aggression. In contrast, respect for the aggressive protagonist was not related to any form of aggression. These findings suggest that deficits in the appreciation of fairness may result in a lack of motivation to emulate such behaviors, which may in turn lead these children to engage in other behaviors that may be viewed as more beneficial to them.

Respect and Prosocial Behavior

Similarly, the current empirical literature on respect and prosocial behavior is sparse. Nevertheless, some evidence does suggest that respect is associated with higher levels of prosocial behavior in children and adolescents. In a sample of 146 7- and 15-year-olds, respect was examined in the context of four types of social behaviors, including fairness, prosociality, social inclusiveness, and refraining from harming (Zuffiano et al., 2015). Although respect did not relate directly to sharing behavior, it did interact with caregiver-reported sympathy to predict sharing. That is, at low (but not medium or high) levels of sympathy, high respect for prosocial others was associated with higher levels of sharing, suggesting that feeling respect for prosocial others may help children who are less concerned for needy others to engage in more prosocial behavior, even when the cost of behavior is high (e.g., sharing).

Conclusions and Future Directions

In this chapter, we reviewed theoretical approaches and selected empirical work on the development of emotions in the context of conflict and morality. We focused on four emotions (guilt, sympathy, pride, respect), each of which represents a prototypical emotional experience (positively or negatively valenced, self-conscious or other-oriented) in these contexts. We also discussed temperamental and socialization pathways to the development of these emotions including gender differences and their links with social behaviors across childhood and adolescence.

In summary, research highlights the role of both temperament and parental socialization in the development of negatively valenced moral emotions (guilt and sympathy) whereas gaps remain in how positively valenced moral emotions (pride and respect) develop. Moreover, there is evidence, in varying degrees, to link both negatively valenced moral emotions (guilt and sympathy) and positively valenced moral emotions (pride and respect) to prosocial and aggressive behaviors. Linking back to our theoretical model, there is scattered work investigating how factors such as biology, context, and age influence the development of these emotions; moreover, systematic work looking into how they work together is still lacking, especially for positively valenced emotions. Going forward, comprehensive research is needed to better understand the development of these emotions, in particular, when and how they develop and how they contribute to prosocial and aggressive behaviors.

Here we identify a few areas of future research in this field: (1) factors (e.g., temperament, socialization) that influence the development of these emotions (especially positively valenced emotions); (2) their links to behavioral outcomes over time; (3) the specific mechanisms involved in the distinct pathways of guilt, sympathy, pride, and respect to social behaviors; and (4) how knowledge on the normative development of emotions in these contexts can be utilized to inform practices aimed at impeding aggression and enhancing prosocial development across childhood and adolescence (see Malti, Chaparro, Zuffianò, & Colasante, 2016). To address these questions, more longitudinal research is needed. Future research is also needed to examine how moral emotions interact with other well-documented protective and risk factors, such as social-cognitive deficits (e.g., Dodge, Coie, & Lynam, 2006) and emotion regulation skills (e.g., Eisenberg et al., 2015), as mentioned in our theoretical model, to predict intraindividual and interindividual differences in aggressive and prosocial behaviors.

To fully understand how emotions in contexts of conflict and morality emerge, research also needs to explore the mechanisms underlying the components involved in the emotional experience (see Scherer, 2009). Developmental research on emotions has focused little attention on the processes that occur between the eliciting event and action tendency—that is, attention allocation, physiological arousal, and facial expressions (see Malti et al., 2018). For instance, despite the important role physiology plays in children's expression of sympathy (see Zahn-Waxler et al., 1995), relatively little is known about the physiological processes underlying various types of emotions in contexts of moral conflict (e.g., Dys & Malti, 2016). Similarly, other work has highlighted the importance of attention allocation and facial expressions in moral development (Crick & Dodge, 1994; Ekman, 1993; Hoffman, 2000); yet, little empirical research has focused on links between emotions with attention allocation and facial expressions. By advancing our understanding of these mechanisms, we may gain a deeper knowledge of inter- and intraindividual differences in emotions in contexts of conflict and morality.

References

Acland, E. L., Colasante, T., & Malti, T. (in press). Respiratory sinus arrhythmia and prosociality in childhood: Evidence for a quadratic effect. *Developmental psychobiology.*

Aknin, L. B., Hamlin, J. K., & Dunn, E. W. (2012). Giving leads to happiness in young children. *PLoS One, 7*(6), e39211. https://doi.org/10.1371/journal.pone.0039211

Armstrong, T. A., Keller, S., Franklin, T. W., & Macmillan, S. N. (2009). Low resting heart rate and antisocial behavior: A brief review of evidence and preliminary results from a new test. *Criminal Justice and Behavior, 36*(11), 1125–1140. https://doi.org/10.1177/0093854809342855

Arsenio, W. (2014). Moral emotion attributions and aggression. In M. Killen & J. Smetana (Eds.), *Handbook of moral development* (2nd ed., pp. 235–255). New York, NY: Psychology Press.

Baker, E., Baibazarova, E., Ktistaki, G., Shelton, K. H., & Van Goozen, S. H. (2012). Development of fear and guilt in young children: Stability over time and relations with psychopathology. *Development and Psychopathology, 24*(3), 833–845. https://doi.org/10.1017/S0954579412000399

Bedford, O., & Hwang, K. K. (2003). Guilt and shame in Chinese culture: A cross-cultural framework from the perspective of morality and identity. *Journal of*

Theory of Social Behavior, 33(2), 127–144. https://doi.org/10.1111/1468-5914.00210

Bischof-Köhler, D. (2012). Empathy and self-recognition in phylogenetic and ontogenetic perspective. *Emotion Review, 4*(1), 40–48. https://doi.org/10.1177/1754073911421377

Boezeman, E. J., & Ellemers, N. (2008). Pride and respect in volunteers' organizational commitment. *European Journal of Social Psychology, 38*, 159–172. https://doi.org/10.1002/ejsp.415

Burnstein, E., Crandall, C., & Kitayama, S. (1994). Some neo-Darwinian decision rules for altruism: Weighing cues for inclusive fitness as a function of the biological importance of the decision. *Journal of Personality and Social Psychology, 67*, 773–789. https://doi.org/10.1037/0022-3514.67.5.773

Carlo, G., McGinley, M., Hayes, R., Batenhorst, C., & Wilkinson, J. (2007). Parenting style or practices? Parenting, sympathy, and prosocial behaviors among adolescents. *The Journal of Genetic Psychology, 168*(2), 147–176. https://doi.org/10.3200/GNTP.168.2.147-176

Carlo, G., Mestre, M. V., Samper, P., Tur, A., & Armenta, B. E. (2011). The longitudinal relations among dimensions of parenting styles, sympathy, prosocial moral reasoning, and prosocial behaviors. *International Journal of Behavioral Development, 35*(2), 116–124. https://doi.org/10.1177/0165025410375921

Carlo, G., Padilla-Walker, L. M., & Nielson, M. G. (2015). Longitudinal bidirectional relations between adolescents' sympathy and prosocial behaviour. *Developmental Psychology, 51*(12), 1771–1777. https://doi.org/10.1037/dev0000056

Chaplin, T. M., & Aldao, A. (2013). Gender differences in emotion expression in children: A meta-analytic review. *Psychological Bulletin, 139*(4), 735–765. https://doi.org/10.1037/a0030737

Colasante, T., & Malti, T. (2017). Resting heart rate, guilt, and sympathy: A developmental psychophysiological study of physical aggression. *Psychophysiology, 54*(11), 1770–1781. https://doi.org/10.1111/psyp.12915

Colasante, T., Zuffianò, A., Bae, N. Y., & Malti, T. (2014). Inhibitory control and moral emotions: Relations to reparation in early and middle childhood. *Journal of genetic psychology, 175*(6), 511–527. https://doi.org/10.1080/00221325.2014.976535

Colasante, T., Zuffianò, A., & Malti, T. (2015). Do moral emotions buffer the anger-aggression link in children and adolescents? *Journal of Applied Developmental Psychology, 41*, 1–7. https://doi.org/10.1016/j.appdev.2015.06.001

Colasante, T., Zuffianò, A., & Malti, T. (2016). Daily deviations in anger, guilt, and sympathy: A developmental diary study of aggression. *Journal of Abnormal Child Psychology, 44*, 1515–1526. https://doi.org/10.1007/s10802-016-0143-y

Cornell, A. H., & Frick, P. J. (2007). The moderating effects of parenting styles in the association between behavioural inhibition and parent-reported guilt and empathy in preschool children. *Journal of Clinical Child & Adolescent Psychology, 36*(3), 305–318. https://doi.org/10.1080/15374410701444181

Covert, M. V., Tangney, J. P., Maddux, J. E., & Heleno, N. M. (2003). Shame-proneness, guilt-proneness, and interpersonal problem solving: A social cognitive analysis. *Journal of Social and Clinical Psychology, 22*(1), 1–12. https://doi.org/10.1521/jscp.22.1.1.22765

Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. *Psychological Bulletin, 115*(1), 74–101. https://doi.org/10.1037/0033-2909.115.1.74

Dadds, M. R., Moul, C., Cauchi, A., Dobson-Stone, C., Hawes, D. J., Brennan, J., & Ebstein, R. E. (2014). Methylation of the oxytocin receptor gene and oxytocin blood levels in the development of psychopathy. *Development and Psychopathology, 26*(1), 33–40. https://doi.org/10.1017/S0954579413000497

Daniel, E., Dys, S. P., Buchmann, M., & Malti, T. (2016). Developmental trajectories of social justice values in adolescence: Relations with sympathy and friendship quality. *Social Development, 25*(3), 548–564. https://doi.org/10.1111/sode.12146

Davidov, M., Zahn-Waxler, C., Roth-Hanania, R., & Knafo, A. (2013). Concern for others in the first year of life: Theory, evidence, and avenues for research. *Child Development Perspectives, 7*(2), 126–131. https://doi.org/10.1111/cdep.12028

Davis, M. H., Luce, C., & Kraus, S. J. (1994). The heritability of characteristics associated with dispositional empathy. *Journal of Personality, 62*(3), 369–391. https://doi.org/10.1111/j.1467-6494.1994.tb00302.x

Dinolfo, C., & Malti, T. (2013). Interpretive understanding, sympathy, and moral emotion attribution in oppositional defiant disorder symptomatology. *Child Psychiatry & Human Development, 44*(5), 633–645. https://doi.org/10.1007/s10578-013-0357-y

Dodge, K. A., Coie, J. D., & Lynam, D. (2006). Aggression and antisocial behavior in youth. In N. Eisenberg, W. Damon, & R. L. Lerner (Eds.), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development* (6th ed., pp. 719–788). New York, NY: Wiley.

Dondi, K. A., Simion, F., & Caltran, G. (1999). Can newborns discriminate between their own cry and the cry of another newborn infant? *Developmental Psychology, 35*, 418–426. https://doi.org/10.1037/0012-1649.35.2.418

Drummond, J. D. K., Hammond, S. I., Satlof-Bedrick, E., Waugh, W. E., & Brownell, C. A. (2016). Helping the one you hurt: Toddlers' rudimentary guilt, shame, and prosocial behaviour after harming another. *Child Development, 88*(4), 1382–1397. https://doi.org/10.1111/cdev.12653

Dys, S. P., & Malti, T. (2016). It's a two-way street: Automatic and controlled processes in children's emotional responses to moral transgressions. *Journal of experimental child psychology, 152*, 31–40. https://doi.org/10.1016/j.jecp.2016.06.011

Ebstein, R. P., Israel, S., Chew, S. H., Zhong, S., & Knafo, A. (2010). Genetics of human social behavior. *Neuron, 65*(6), 831–844. https://doi.org/10.1016/j.neuron.2010.02.020

Edwards, A., Eisenberg, N., Spinrad, T. L., Reiser, M., Eggum-Wilkens, N. D., & Liew, J. (2015). Predicting sympathy and prosocial behavior from young children's dispositional sadness. *Social Development, 24*(1), 76–94. https://doi.org/10.1111/sode.12084

Eisenberg, N. (2000). Emotion, regulation, and moral development. *Annual Review of Psychology, 51*, 665–697. https://doi.org/10.1146/annurev.psych.51.1.665

Eisenberg, N., Eggum, N. D., & Di Giunta, L. (2010). Empathy-related responding: Associations with prosocial behavior, aggression, and intergroup relations. *Social Issues and Policy Review, 4*(1), 143–180. https://doi.org/10.1111/j.1751-2409.2010.01020.x

Eisenberg, N., Fabes, R. A., Murphy, B., Karbon, M., Smith, M., & Maszk, P. (1996). The relations of children's dispositional empathy-related responding to their emotionality, regulation, and social functioning. *Developmental Psychology, 32*(2), 195–209. https://doi.org/10.1037/0012-1649.32.2.195

Eisenberg, N., Fabes, R. A., Shepard, S. A., Murphy, B. C., Guthrie, I. K., Jones, S., … Maszk, P. (1997). Contemporaneous and longitudinal prediction of children's social functioning from regulation and emotionality. *Child Development, 68*(4), 642–664. https://doi.org/10.1111/j.1467-8624.1997.tb04227.x

Eisenberg, N., & Lennon, R. (1983). Sex differences in empathy and related capacities. *Psychological Bulletin, 94*(1), 100–131. https://doi.org/10.1037/0033-2909.94.1.100

Eisenberg, N., Michalik, N., Spinrad, T. L., Hofer, C., Kupfer, A., Valiente, C., … Reiser, M. (2007). The relations of effortful control and impulsivity to children's sympathy: A longitudinal study. *Cognitive Development, 22*(4), 544–567. https://doi.org/10.1016/j.cogdev.2007.08.003

Eisenberg, N., Miller, P. A., Shell, R., McNalley, S., & Shea, C. (1991). Prosocial development in adolescence: A longitudinal study. *Developmental Psychology, 27*(5), 849–857.

Eisenberg, N., Spinrad, T., & Morris, A. (2014). Empathy-related responding in children. In M. Killen & J. Smetana (Eds.), *Handbook of moral development* (2nd ed., pp. 184–207). New York, NY: Psychology Press.

Eisenberg, N., Spinrad, T. L., & Knafo-Noam, A. (2015). Prosocial development. In R. M. Lerner (Ed.), *Handbook of child psychology and developmental science* (7th ed., pp. 184–207). New York, NY: Wiley. https://doi.org/10.1002/9781118963418.childpsy315

Eisenberg, N., Zhou, Q., & Koller, S. (2001). Brazilian adolescents' prosocial moral judgment and behavior: Relations to sympathy, perspective taking, gender-role orientation, and demographic characteristics. *Child Development, 72*(2), 518–534. https://doi.org/10.1111/1467-8624.00294

Eisenberg, N., Zhou, Q., Spinrad, T. L., Valiente, C., Fabes, R. A., & Liew, J. (2005). Relations among positive parenting, children's effortful control, and externalizing problems: A three-wave longitudinal study. *Child Development, 76*(5), 1055–1071. https://doi.org/10.1111/j.1467-8624.2005.00897.x

Ekman, P. (1993). Facial expression and emotion. *American Psychologist, 48*, 384–392. https://doi.org/10.1037/0003-066X.48.4.384

Else-Quest, N. M., Higgins, A., Allison, C., & Morton, L. C. (2012). Gender differences in self-conscious emotional experience: A meta-analysis. *Psychological Bulletin, 138*(5), 947–981. https://doi.org/10.1037/a0027930

Etxebarria, I., Ortiz, M., Apodaca, P., Pascual, A., & Conejero, S. (2015). Pride as moral motive: Moral pride and prosocial behaviour. *Journal for Study of Education and Development, 38*(4), 746–774. https://doi.org/10.1080/02103702.2015.1076267

Ferguson, T. J., Stegge, H., Miller, E. R., & Olsen, M. E. (1999). Guilt, shame, and symptoms in children. *Developmental Psychology, 35*(2), 347–357. https://doi.org/10.1037/0012-1649.35.2.347

Frijda, N. H. (1994). Emotions require cognitions, even if simple ones. In P. Ekman & R. J. Davidson (Eds.), *The nature of emotion* (pp. 197–202). New York, NY: Oxford University Press.

Gibbard, A. (1990). *Wise choices, apt feelings: A theory of normative judgment*. Cambridge, MA: Harvard University Press.

Gordon, I., Jack, A., Pretzsch, C. M., Vander Wyk, B., Leckman, J. F., Feldman, R., & Pelphrey, K. A. (2016). Intranasal oxytocin enhances connectivity in the neural circuitry supporting social motivation and social perception in children with autism. *Scientific Reports, 6*, 35054. https://doi.org/10.1038/srep35054

Guastella, A. J., Einfeld, S. L., Gray, K. M., Rinehart, N. J., Tonge, B. J., Lambert, T. J., & Hickie, I. B. (2010). Intranasal oxytocin improves emotion recognition for youth with autism spectrum disorders. *Biological Psychiatry, 67*(7), 692–694. https://doi.org/10.1016/j.biopsych.2009.09.020

Guastella, A. J., Mitchell, P. B., & Dadds, M. R. (2008). Oxytocin increases gaze to the eye region of human faces. *Biological Psychiatry, 63*(1), 3–5. https://doi.org/10.1016/j.biopsych.2007.06.026

Hart, D., & Matsuba, K. M. (2007). The development of pride and moral life. In J. L. Tracy, R. W. Robbins, & J. P. Tangney (Eds.), *The self-conscious emotions* (pp. 114–133). New York, NY: Guilford.

Hastings, P. D., & Miller, J. G. (2014). Autonomic regulation, polyvagal theory, and children's prosocial development. In L. Padilla-Walker & G. Carlo (Eds.), *Prosocial development: A multidimensional approach* (pp. 112–127). New York, NY: Oxford University Press.

Hastings, P. D., Zahn-Waxler, C., Robinson, J., Usher, B., & Bridges, D. (2000). The development of concern for others in children with behavior problems. *Developmental Psychology, 36*(5), 531–546. https://doi.org/10.1037//0O12-1649.36.5.531

Hepach, R., Vaish, A., & Tomasello, M. (2017). The fulfillment of others' needs elevates children's body posture. *Developmental Psychology, 53*(1), 100–113. https://doi.org/10.1037/dev0000173

Hoffman, M. L. (2000). *Empathy and moral development: Implications for caring and justice*. Cambridge, UK: Cambridge University Press. https://doi.org/10.1017/CBO9780511805851

Kant, I. (1797/1996). *Die Metaphysik der Sitten* (*The metaphysics of moral*) (M. Gregor, Ed. & Trans.). Cambridge, UK: Cambridge University Press

Kassam, K. S., & Mendes, W. B. (2013). The effects of measuring emotion: Physiological reactions to emotional situations depend on whether someone is asking. *PLoS One, 8*(6), e64959. https://doi.org/10.1371/journal.pone.0064959

Keller, M., Lourenço, O., Malti, T., & Saalbach, H. (2003). The multifaceted phenomenon of "happy victimizers": A cross-cultural comparison of moral emotions. *British Journal of Developmental Psychology, 21*(1), 1–18. https://doi.org/10.1348/026151003321164582

Kienbaum, J. (2014). The development of sympathy from 5 to 7 years: Increase, decline, or stability? A longitudinal study. *Frontiers in Psychology, 5*, 1–10. https://doi.org/10.3389/fpsyg.2014.00468

Killen, M., Mulvey, K. L., Richardson, C., Jampol, N., & Woodward, A. (2011). The accidental transgressor: Morally-relevant theory of mind. *Cognition, 119*, 197–215.

Kim, S., Thibodeau, R., & Jorgensen, R. S. (2011). Shame, guilt, and depressive symptoms: A meta-analytic review. *Psychological Bulletin, 137*(1), 68–96. https://doi.org/10.1037/a0021466

Knafo, A., Zahn-Waxler, C., Van Hulle, C., Robinson, J. L., & Rhee, S. H. (2008). The developmental origins of a disposition toward empathy: Genetic and environmental contributions. *Emotion, 8*(6), 737–752. https://doi.org/10.1037/a0014179

Kochanska, G. (1993). Toward a synthesis of parental socialization and child temperament in early development of conscience. *Child Development, 64*(2), 325–347. https://doi.org/10.2307/1131254

Kochanska, G., DeVet, K., Goldman, M., Murray, K., & Putnam, S. P. (1994). Maternal reports of conscience development and temperament in young children. *Child development, 65*(3), 852–868. https://doi.org/10.1111/j.1467-8624.1994.tb00788.x

Kochanska, G. (1997). Multiple pathways to conscience for children with different temperaments: From toddlerhood to age 5. *Developmental Psychology, 33*(2), 228–240. https://doi.org/10.1037/0012-1649.33.2.228

Kochanska, G., Barry, R. A., Jimenez, N. B., Hollatz, A. L., & Woodard, J. (2009). Guilt and effortful control: Two mechanisms that prevent disruptive developmental trajectories. *Journal of Personality and Social Psychology, 97*(2), 322–333. https://doi.org/10.1037/a0015471

Kochanska, G., Gross, J. N., Lin, M., & Nichols, K. E. (2002). Guilt in young children: Development, determinants, and relations with a broader system of standards. *Child Development, 73*(2), 461–482. https://doi.org/10.1111/1467-8624.00418

Kogan, A., Oveis, C., Carr, E. W., Gruber, J., Mauss, I. B., Shallcross, A., … Keltner, D. (2014). Vagal activity is quadratically related to prosocial traits, prosocial emotions, and observer perceptions of prosociality. *Journal of Personality and Social Psychology, 107*(6), 1051–1063. https://doi.org/10.1037/a0037509

Korchmaros, J. D., & Kenny, D. A. (2001). Emotional closeness as a mediator of the effect of genetic relatedness on altruism. *Psychological Science, 12*, 262–265. https://doi.org/10.1111/1467-9280.00348

Krahé, B. (2013). *The social psychology of aggression*. Hove, UK: Psychology Press.

Krettenauer, T., & Casey, V. (2015). Moral identity development and positive moral emotions: Differences involving authentic and hubristic pride. *Identity, 15*(3), 173–187. https://doi.org/10.1080/15283488.2015.1023441

Krettenauer, T., Jia, F., & Mosleh, M. (2011). The role of emotion expectancies in adolescents' moral decision making. *Journal of Experimental Child Psychology, 108*, 358–370. https://doi.org/10.1016/j.jecp.2010.08.014

Krettenauer, T., & Johnston, M. (2011). Positively versus negatively charged moral emotion expectancies in adolescence: The role of situational context and the developing moral self. *British Journal of Developmental Psychology, 29*, 475–488. https://doi.org/10.1348/026151010X508083

Laible, D., & Carlo, G. (2004). The differential relations of maternal and paternal support and control to adolescent social competence, self-worth, and sympathy. *Journal of Adolescent Research, 19*(6), 759–782. https://doi.org/10.1177/0743558403260094

Lazarus, R. (1991). *Emotion and adaptation*. New York, NY: Oxford Press.

Lorber, M. F. (2004). Psychophysiology of aggression, psychopathy, and conduct problems: A meta-analysis. *Psychological Bulletin, 130*(4), 531–552. https://doi.org/10.1037/0033-2909.130.4.531

Lovett, B. J., & Sheffield, R. A. (2007). Affective empathy deficits in aggressive children and adolescents: A critical review. *Clinical Psychology Review, 27*(1), 1–13. https://doi.org/10.1016/j.cpr.2006.03.003

MacEvoy, J. P., & Leff, S. S. (2012). Children's sympathy for peers who are the targets of peer aggression. *Journal of Abnormal Child Psychology, 40*(7), 1137–1148. https://doi.org/10.1007/s10802-012-9636-5

Malti, T. (2016). Toward an integrated clinical-developmental model of guilt. *Developmental Review, 39*, 16–36. https://doi.org/10.1016/j.dr.2015.11.001

Malti, T., Chaparro, M. P., Zuffianò, A., & Colasante, T. (2016). School-based interventions to promote empathy-related responding in children and adolescents: A developmental analysis. *Journal of Clinical Child and Adolescent Psychology, 45*(6), 718–731. https://doi.org/10.1080/15374416.2015.112

Malti, T., Colasante, T., Zuffianò, A., & de Bruine, M. (2016). The physiological correlates of children's emotions in contexts of moral transgression. *Journal*

of experimental child psychology, 142, 372–381. https://doi.org/10.1016/j.jecp.2015.09.017

Malti, T., Dys, S. P., Colasante, T., & Peplak, J. (2018). Emotions and morality: New developmental perspectives. In C. Helwig (Vol. Ed.) & M. Harris (Series Ed.), *Current issues in developmental psychology: New perspectives on moral development.* New York, NY: Psychology Press.

Malti, T., Eisenberg, N., Kim, H., & Buchmann, M. (2013). Developmental trajectories of sympathy, moral emotion attributions, and moral reasoning: The role of parental support. *Social Development, 22*(4), 773–793. https://doi.org/10.1111/sode.12031

Malti, T., Gummerum, M., Keller, M., & Buchmann, M. (2009). Children's moral motivation, sympathy, and prosocial behavior. *Child Development, 80*, 442–460. https://doi.org/10.1111/j.1467-8624.2009.01271.x

Malti, T., & Keller, M. (2010). Development of moral emotions in cultural context. In W. Arsenio & E. Lemerise (Eds.), *Emotions, aggression, and morality in children: Bridging development and psychopathology* (pp. 177–198). Washington, DC: American Psychological Association.

Malti, T., Keller, M., & Buchmann, M. (2013). Do moral choices make us feel good? The development of adolescents' emotions following moral decision making. *Journal of Research on Adolescence, 23*(2), 389–397. https://doi.org/10.1111/jora.12005

Malti, T., & Krettenauer, T. (2013). The relation of moral emotion attributions to prosocial and antisocial behaviour: A meta-analysis. *Child Development, 84*(2), 397–412. https://doi.org/10.1111/j.1467-8624.2012.01851.x

Malti, T., & Latzko, B. (2017). Moral emotions. In J. Stein (Ed.), *Reference module on neuroscience and biobehavioral psychology*. Oxford, UK: Elsevier. https://doi.org/10.1016/B978-0-12-809324-5.06491-9

Malti, T., & Ongley, S. F. (2014). The development of moral emotions and moral reasoning. In M. Killen & J. Smetana (Eds.), *Handbook of moral development* (2nd ed., pp. 163–183). New York, NY: Psychology Press.

Malti, T., Ongley, S. F., Peplak, J., Chaparro, M. P., Buchmann, M., Zuffianò, A., & Cui, L. (2016). Children's sympathy, guilt, and moral reasoning in helping, cooperation, and sharing: A 6-year longitudinal study. *Child Development, 87*(6), 1783–1795. https://doi.org/10.1111/cdev.12632

Malti, T., Sette, S., & Dys, S. P. (2016). Social-emotional responding: A perspective from developmental psychology. In R. Scott, S. Kosslyn, & M. Buchmann (Eds.), *Emerging trends in the social and behavioural sciences* (pp. 1–15). Hoboken, NJ: John Wiley and Sons. http://doi.org/10.1002/9781118900772.etrds0415

Malti, T., Peplak, J., Myatt, E., & Zhang, L. (2019). The development of respect in childhood and adolescence. Manuscript under review.

Matthews, K. A., Batson, C. D., Horn, J., & Rosenman, R. H. (1981). "Principles in his nature which interest him in the fortune of others…": The heritability of empathic concern for others. *Journal of Personality, 49*(3), 237–247. https://doi.org/10.1111/j.1467-6494.1981.tb00933.x

McRae, K., Taitano, E. K., & Lane, R. D. (2010). The effects of verbal labelling with psychophysiology: Objective but not subjective emotion labelling reduces skin-conductance responses to briefly presented pictures. *Cognition & Emotion, 24*(5), 829–839. https://doi.org/10.1080/02699930902797141

Menesini, E., & Camodeca, M. (2008). Shame and guilt as behaviour regulators: Relationships with bullying, victimization and prosocial behaviour. *British Journal of Developmental Psychology, 26*(2), 183–196. https://doi.org/10.1348/026151007X205281

Menesini, E., Sanchez, V., Fonzi, A., Ortega, R., Costabile, A., & Lo Feudo, G. (2003). Moral emotions and bullying: A cross-national comparison of differences between bullies, victims and outsiders. *Aggressive Behavior, 29*(6), 515–530. https://doi.org/10.1002/ab.10060

Miller, J. G., Kahle, S., & Hastings, P. D. (2017). Moderate baseline vagal tone predicts greater prosociality in children. *Developmental Psychology, 53*(2), 274. https://doi.org/10.1037/dev0000238

Mintz, G., Etengoff, C., & Grysman, A. (2017). The relation between childhood parenting and emerging adults' experiences of shame and guilt. *Journal of Child and Family Studies, 26*(10), 2908–2920. https://doi.org/10.1007/s10826-017-0778-5

Murphy, T. P., Laible, D. J., Augustine, M., & Robeson, L. (2015). Attachment's links with adolescents' social emotions: The roles of negative emotionality and emotion regulation. *The Journal of Genetic Psychology, 176*(5), 315–329. https://doi.org/10.1080/00221325.2015.1072082

Nucci, L. P., & Gingo, M. (2011). The development of moral reasoning. In U. Goswami (Ed.), *The Wiley-Blackwell handbook of childhood cognitive development* (2nd ed., pp. 420–444). Malden, MA: Wiley-Blackwell.

Obradović, J., Bush, N. R., Stamperdahl, J., Adler, N. E., & Boyce, W. T. (2010). Biological sensitivity to context: The interactive effects of stress reactivity and family adversity on socioemotional behavior and school readiness. *Child Development, 81*(1), 270–289. https://doi.org/10.1111/j.1467-8624.2009.01394.x

Olthof, T. (2012). Anticipated feelings of guilt and shame as predictors of early adolescents' antisocial and prosocial interpersonal behaviour. *European Journal of Developmental Psychology, 9*(3), 371–388. https://doi.org/10.1080/17405629.2012.680300

Ongley, S. F., & Malti, T. (2014). The role of moral emotions in the development of children's sharing behaviour. *Developmental Psychology, 50*(4), 1148–1159. https://doi.org/10.1037/a0035191

Orth, U., Robins, R. W., & Soto, C. J. (2010). Tracking the trajectory of shame, guilt, and pride across the life span. *Journal of Personality and Social Psychology, 99*(6), 1061–1071. https://doi.org/10.1037/a0021342

Ortiz, J., & Raine, A. (2004). Heart rate level and antisocial behavior in children and adolescents: A meta-analysis. *Journal of the American Academy of Child & Adolescent Psychiatry, 43*(2), 154–162. https://doi.org/10.1097/00004583-200402000-00010

Peplak, J., & Malti, T. (2017). "That really hurt, Charlie!" investigating the role of sympathy and moral respect in children's aggressive behaviour. *The Journal of Genetic Psychology, 178*(2), 89–101. https://doi.org/10.1080/00221325.2016.1245178

Perren, S., & Gutzwiller-Helfenfinger, E. (2012). Cyberbullying and traditional bullying in adolescence: Differential roles of moral disengagement, moral emotions, and moral values. *European Journal of Developmental Psychology, 9*(2), 195–209. https://doi.org/10.1080/17405629.2011.643168

Phinney, J., Feshbach, N., & Farver, J. (1986). Preschool children's responses to peer crying. *Early Childhood Research Quarterly, 1*, 207–219. https://doi.org/10.1016/0885-2006(86)90030-X

Piaget, J. (1932/1965). *The moral judgment of the child.* New York, NY: The Free Press. (Original work published in 1932).

Plant, E. A., Hyde, J. S., Keltner, D., & Devine, P. G. (2000). The gender stereotyping of emotions. *Psychology of Women Quarterly*, *24*, 81–92. https://doi.org/10.1111/j.1471-6402.2000.tb01024.x

Portnoy, J., & Farrington, D. P. (2015). Resting heart rate and antisocial behavior: An updated systematic review and meta-analysis. *Aggression and Violent Behavior, 22*, 33–45. https://doi.org/10.1016/j.avb.2015.02.004

Raine, A. (2008). From genes to brain to antisocial behavior. *Current Directions in Psychological Science, 17*(5), 323–328. https://doi.org/10.1111/j.1467-8721.2008.00599.x

Rhee, S., Boeldt, D. L., Friedman, N. P., Corley, R. P., Hewitt, J. K., Young, S. E., … Zahn-Waxler, C. (2013). The role of language in concern and disregard for others in the first years of life. *Developmental Psychology, 49*(2), 197–214. https://doi.org/10.1037/a0028318

Roberts, W., Strayer, J., & Denham, S. (2014). Empathy, anger, guilt: Emotions and prosocial behaviour. *Canadian Journal of Behavioural Science, 46*(4), 465–474. https://doi.org/10.1037/a0035057

Rodrigues, S. M., Saslow, L. R., Garcia, N., John, O. P., & Keltner, D. (2009). Oxytocin receptor genetic variation relates to empathy and stress reactivity in humans. *Proceedings of the National Academy of Sciences, 106*(50), 21437–21441. https://doi.org/10.1073/pnas.0909579106

Roos, S., Hodges, E. V. E., & Salmivalli, C. (2014). Do guilt- and shame-proneness differentially predict prosocial, aggressive, and withdrawn behaviors during early adolescence? *Developmental Psychology, 50*(3), 941–946. https://doi.org/10.1037/a0033904

Roos, S., Salmivalli, C., & Hodges, E. V. E. (2011). Person x context effects on anticipated moral emotions following aggression. *Social Development, 20*(4), 685–702. https://doi.org/10.1111/j.1467-9507.2011.00603.x

Rothbart, M. K., Ahadi, S. A., & Hershey, K. L. (1994). Temperament and social behavior in childhood. *Merrill-Palmer Quarterly, 40*(1), 21–39.

Roth-Hanania, R., Davidov, M., & Zahn-Waxler, C. (2011). Empathy development from 8 to 16 months: Early signs of concern for others. *Infant Behavior and Development, 34*(3), 447–458. https://doi.org/10.1016/j.infbeh.2011.04.007

Rubin, K. H., Coplan, R., Chen, X., Bowker, J. C., McDonald, K., & Heverly-Fitt, S. (2015). Peer relationships in childhood. In M. H. Bornstein & M. E. Lamb (Eds.), *Developmental science: An advanced textbook* (7th ed., pp. 591–649). New York, NY: Psychology Press.

Scherer, K. R. (2009). The dynamic architecture of emotion: Evidence for the component process model. *Cognition and Emotion, 23*(7), 1307–1351. https://doi.org/10.1080/02699930902928969

Schulz, K., Rudolph, A., Tscharaktschiew, N., & Rudolph, U. (2013). Daniel has fallen into a muddy puddle—schadenfreude or sympathy? *British Journal of Developmental Psychology, 31*(4), 363–378. https://doi.org/10.1111/bjdp.12013

Shahrestani, S., Kemp, A. H., & Guastella, A. J. (2013). The impact of a single administration of intranasal oxytocin on the recognition of basic emotions in humans: A meta-analysis. *Neuropsychopharmacology, 38*(10), 1929–1936. https://doi.org/10.1038/npp.2013.86

Shwalb, B. J., & Shwalb, D. W. (2006). Concept development of respect and disrespect in American kindergarten and first- and second-grade children. *New Directions for Child and Adolescent Development, 114*, 67–80. https://doi.org/10.1002/cad

Sivaselvachandran, S., Acland, E. L., Abdallah, S., & Martin, L. J. (2018). Behavioral and mechanistic insight into rodent empathy. *Neuroscience & Biobehavioral Reviews, 91*, 130–137. https://doi.org/10.1016/j.neubiorev.2016.06.007

Smith, K. E., Porges, E. C., Norman, G. J., Connelly, J. J., & Decety, J. (2014). Oxytocin receptor gene variation predicts empathic concern and autonomic arousal while perceiving harm to others. *Social Neuroscience, 9*(1), 1–9. https://doi.org/10.1080/17470919.2013.863223

Stifter, C. A., Cipriano, E., Conway, A., & Kelleher, R. (2009). Temperament and the development of conscience: The moderating role of effortful control. *Social Development, 18*(2), 353–374. https://doi.org/10.1111/j.1467-9507.2008.00491.x

Stuewig, J., & McCloskey, L. A. (2005). The relation of child maltreatment to shame and guilt among adolescents: Psychological routes to depression and delinquency. *Child Maltreatment, 10*(4), 324–336. https://doi.org/10.1177/1077559505279308

Stuewig, J., Tangney, J. P., Kendall, S., Folk, J. B., Meyer, C. R., & Dearing, R. L. (2015). Children's proneness to shame and guilt predict risky and illegal behaviors in young adulthood. *Child Psychiatry and Human Development, 46*(2), 217–227. https://doi.org/10.1007/s10578-014-0467-1

Tangney, J. P., Stuewig, J., & Mashek, D. J. (2007). What's moral about the self-conscious emotions? In L. J. Tracy, R. W. Robins, & J. P. Tangney (Eds.), *The self-conscious emotions: Theory and research* (pp. 21–37). New York, NY: Guilford Press.

Taylor, Z. E., Eisenberg, N., & Spinrad, T. L. (2015). Respiratory sinus arrhythmia, effortful control, and parenting as predictors of children's sympathy across early childhood. *Developmental Psychology, 51*(1), 17–25. https://doi.org/10.1037/a0038189

Thompson, R. A., & Lagattuta, K. H. (2006). Feeling and Understanding: Early Emotional Development. In K. McCartney & D. Phillips (Eds.), Blackwell handbooks of developmental psychology. *Blackwell handbook of early childhood development* (pp. 317–337). Malden: Blackwell Publishing. http://dx.doi.org/10.1002/9780470757703.ch16

Tracy, J. L., & Robins, R. W. (2007). The psychological structure of pride: A tale of two facets. *Journal of personality and social psychology, 92*(3), 506–525. http://dx.doi.org/10.1037/0022-3514.92.3.506

Trommsdorff, G., Friedlmeier, W., & Mayer, B. (2007). Sympathy, distress, and prosocial behavior of preschool children in four cultures. *International Journal of Behavioral Development, 31*(3), 284–293. https://doi.org/10.1177/0165025407076441

Turiel, E. (1983). *The development of social knowledge: Morality and convention*. Cambridge, UK: Cambridge University Press.

Vaish, A., Carpenter, M., & Tomasello, M. (2009). Sympathy through affective perspective taking and its relation to prosocial behaviour in toddlers. *Developmental Psychology, 45*(2), 534–543. https://doi.org/10.1037/a0014322

Vaish, A., Carpenter, M., & Tomasello, M. (2016). The early emergence of guilt-motivated prosocial behaviour. *Child Development, 87*(6), 1772–1782. https://doi.org/10.1111/cdev.12628

van Noorden, T. H., Haselager, G. J., Cillessen, A. H., & Bukowski, W. M. (2015). Empathy and involvement in bullying in children and adolescents: A systematic review. *Journal of Youth and Adolescence, 44*(3), 637–657. https://doi.org/10.1007/s10964-014-0135-6

Webb, L., Stegall, S., Mirabile, S., Zeman, J., Shields, A., & Perry-Parrish, C. (2016). The management and expression of pride: Age and gender effects across adolescence. *Journal of Adolescence, 52*, 1–11. https://doi.org/10.1016/j.adolescence.2016.06.009

Wubben, M. J., De Cremer, D., & van Dijk, E. (2012). Is pride a prosocial emotion? Interpersonal effects of authentic and hubristic pride. *Cognition & Emotion, 26*(6), 1084–1097. https://doi.org/10.1080/02699931.2011.646956

Zahn-Waxler, C., Cole, P. M., Welsh, J. D., & Fox, N. A. (1995). Psychophysiological correlates of empathy and prosocial behaviors in preschool children with behavior problems. *Development and Psychopathology, 7*(1), 27–48. https://doi.org/10.1017/S0954579400006325

Zahn-Waxler, C., Radke-Yarrow, M., Wagner, E., & Chapman, M. (1992). Development of concern for others. *Developmental Psychology, 28*, 126–136. https://doi.org/10.1037/0012-1649.28.1.126

Zahn-Waxler, C., Schiro, K., Robinson, J. L., Emde, R. N., & Schmitz, S. (2001). Empathy and prosocial patterns in young MZ and DZ twins: Development and genetic and environmental influences. In R. N. Emde & J. K. Hewitt (Eds.), *Infancy to early childhood: Genetic and environmental influences on developmental change* (pp. 141–162). Oxford, UK: Oxford University Press.

Zuffianò, A., Colasante, T., Buchmann, M., & Malti, T. (2017). The codevelopment of sympathy and overt aggression from middle childhood to early adolescence. *Developmental Psychology, 54*, 98. https://doi.org/10.1037/dev0000417

Zuffiano, A., Colasante, T., Peplak, J., & Malti, T. (2015). Sharing without caring? Respect for moral others compensates for low sympathy in children's sharing. *British Journal of Developmental Psychology, 33*(2), 252–258. https://doi.org/10.1111/bjdp.12084

Culture in Emotional Development

Yang Yang and Qi Wang

Abstract

Research on emotional development has been primarily focused on children from Western, educated, industrialized, rich, and democratic backgrounds. However, cultural beliefs and norms play an important role in the acceptability of children's emotional expressions and emotion-related behaviors. In this chapter, we first provide a brief overview of how people's emotions differ across cultures. Then, we discuss how cultural values shape emotion socialization, particularly parental emotional expressivity, parent-child conversation, and parental reactions to children's emotions, and further point out how these culturally shaped emotion socialization practices influence children's emotional development. Finally, we review literature on children's emotional development across cultures, including cultural similarities and differences in temperament, emotional expression and experience, emotion recognition, emotion knowledge, emotion regulation, and emotional well-being.

Y. Yang
Centre for Research in Child Development, National Institute of Education, Singapore, Singapore

Q. Wang (✉)
Department of Human Development, Cornell University, Ithaca, NY, USA
e-mail: qiwang@cornell.edu

Culture in Emotional Development

Emotion entails a fundamental psychological process deeply rooted in biological and evolutionary origins and widely shared across many species and cultures (Darwin, 1965; Ekman & Friesen, 1971). Yet the manifestation of emotion is intimately associated with cultural experiences. Research has shown that culture shapes every aspect of the emotion process, from situation appraisal to emotion recognition to the subjective experience to display rules and to behavioral responses (e.g., Matsumoto, Yoo, Nakagawa, & Multinational Study of Cultural Display Rules, 2008; Yuki, Maddux, & Masuda, 2007). Such cultural influences further perpetuate across generations in the course of development through socialization (Cole & Tan, 2007; Q. Wang, 2006). In this chapter, we discuss the role of culture in emotional development.

We view culture as a system and a process of symbolic mediation, where values, norms, and beliefs manifest in and through customs, rituals, and practices in directing and regulating both intrapersonal and interpersonal psychological functions (Rogoff, 2003; Super & Harkness, 2002; Q. Wang & Brockmeier, 2002). As such, culture is not defined by geography but reflects a dynamic constellation of ways of life shared by members of a community. Cultural influences on emotion and emotional development can thus be observed both within and across national borders.

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_22

Here we examine research conducted among typically developing children from infancy through emerging adulthood from a variety of countries, regions, races, and ethnicities. We review developmental research related to temperament, emotional experience, emotional expression, emotion recognition, emotion knowledge, emotion regulation, and emotional well-being. We start with a brief overview of cultural influences on various aspects of emotion and move on to discuss pertinent parental socialization practices that convey to children cultural beliefs and attitudes about emotion. We then examine different patterns of emotional development in cultural context.

Cultural Influences on Emotion

Although emotion is a universal psychological process that is underlined by physiological and neurological mechanisms, culture plays a definitive role in shaping how emotion is defined, experienced, and acted on. A host of cultural factors may be at play, including cultural self-construal (Markus & Kitayama, 1991), cultural mode of communication (Hall, 1976), and cultural perceptual styles (Nisbett, 2003). There has been increasing empirical evidence in recent years for the pervasive influence of culture on every aspect of emotion (Heine, 2015). For example, early studies by Ekman and colleagues suggested universality in facial expression and emotion recognition, whereby people from different cultures could readily identify facial expressions of those from other cultures (Ekman & Friesen, 1971; Ekman, Sorenson, & Friesen, 1969). Later research, however, found that people were better at identifying facial expressions of those from their own culture than those from another culture, which suggests that shared cultural experiences contribute to shared emotional expressions (Elfenbein & Ambady, 2002; Russell, 1994).

More recent evidence has further shown that when processing facial expressions, people from different cultures often attend to different parts of the face for emotional cues. For example, in one study, Japanese and American adults were asked to judge the emotions displayed in photos in which top parts and bottom parts showed different emotional expressions (Yuki et al., 2007). Japanese attended more to the top part of the face, whereas Americans attended more to the bottom part of the face. Similarly, another study showed that European adults paid attention to both the eyes and the mouth when judging facial expressions, whereas East Asians focused on the eyes (Jack, Caldara, & Schyns, 2012). Cultural differences have also been found in emotion recognition in speech. In a series of studies, Kitayama and colleagues asked their participants to judge the pleasantness of spoken words with different content meanings and vocal tones. Whereas Asians paid more spontaneous attention to vocal tones to extract emotional information, Americans paid more attention to word meanings (Ishii, Reyes, & Kitayama, 2003; Kitayama & Ishii, 2002).

Culture further influences how individuals attend to and recognize others' emotions in social situations. Masuda and colleagues (Masuda, Wang, Ishii, & Ito, 2012) asked American and Japanese participants to rate the intensity of the emotion presented by a focal figure in front of some background figures. Half of the participants were assigned to a congruent condition in which the focal and background figures expressed the same emotions (e.g., happiness), whereas the other half of the participants were assigned to an incongruent condition in which the central and background figures expressed different emotions (e.g., happiness vs anger). The researchers found that although participants in the two cultures rated the focal figure's emotion similarly in the congruent condition, Japanese were more likely to be influenced by the background figures than Americans in the incongruent condition. For example, when the focal figure showed happiness and the background figures showed anger, Japanese participants' rating of happiness was significantly lower than that of Americans. These findings may reflect general cultural differences in holistic versus analytic perceptual styles in East Asian and Western cultures (Nisbett, 2003).

Furthermore, the cultural differences in emotion expression and recognition may be at least partly due to different cultural values regarding

emotion. People in different cultures tend to hold different views about the value of emotion and how emotion should be experienced, expressed, and regulated (Markus & Kitayama, 1991; Q. Wang, 2013b). For example, in many Western cultures, such as European American culture, where individuality, independence, and autonomy are emphasized, emotion is regarded as reflective of the true self and personal authenticity. Expression of emotions is generally considered to be an assertion of the self and therefore should be cultivated and encouraged (Kitayama, Markus, & Matsumoto, 1995; Q. Wang, 2013b). In contrast, in cultures such as East Asia, people prize group harmony and relatedness, and a great emphasis is placed on moderation of all matters of the heart. Explicit expression or communication of emotions is often viewed as potentially disruptive to social harmony and therefore needs to be strictly controlled (Markus & Kitayama, 1991; Q. Wang, 2013b).

These different cultural views of emotion and emotion expression are further reflected in emotion display rules, namely, culturally specific rules about when, where, and how emotions should be expressed. Whereas Westerners tend to express their emotions explicitly and clearly in order to ascertain themselves, East Asians often express emotions in a more implicit and indirect way (Hall, 1976; Matsumoto, Yoo, & Fontaine, 2008) and tend to suppress emotions in order to preserve social order (Matsumoto, Yoo, Nakagawa, et al., 2008). Display rules are particularly sensitive to social context. When watching a disturbing video, Japanese expressed less disgust in the presence of other people than alone, whereas Americans showed similar emotions when being alone and being with others (Ekman, 1972). Interestingly, whereas cognitive reappraisal is associated with less emotion suppression among Westerners, it is related to more emotion suppression among East Asians (Gross & John, 2003; Matsumoto, Yoo, Nakagawa, et al., 2008). This suggests that East Asians may use emotion suppression as a strategy to regulate their affect.

Cultural influences on emotional expression have also been found in naturalistic settings. For example, in hospitals, cultural differences were found in expressing pains, whereby Italians and Jewish expressed their pains more openly than patients of Irish and Anglo backgrounds (Bates, Edwards, & Anderson, 1993). Winning and losing moments in Olympic games are also great opportunities to observe expressions of both positive and negative emotions by people from different countries. Matsumoto and Willingham (2006) studied emotion expressions of medal winners of the 2004 Athens Olympic Games. They found that although people from all countries displayed spontaneous expressions of positive emotions after winning a medal, they varied in when and how strongly they expressed their emotions and how quickly they were able to control their emotional expressions. Culture further influences ideal affects, namely, the affective states that people want to feel (Tsai, 2007). Whereas European Americans prefer high-arousal positive affect, Asians prefer low-arousal positive affect. Thus, culture not only shapes whether and when individuals express their emotions, but also the intensity of the emotional states they strike for.

Culture in Emotion Socialization

Parents and other socialization agents play an important role in transmitting to children cultural values and attitudes pertinent to emotion. Emotion socialization thus aims to facilitate children's emotional competence specific to the cultural context (Cole & Tan, 2007; Denham, Bassett, & Wyatt, 2007; Eisenberg, Cumberland, & Spinrad, 1998). Eisenberg and colleagues highlighted three major aspects of parents' emotion socialization: parents' own emotional expressivity, parent-child conversation about emotions, and parents' reactions to children emotions (Eisenberg et al., 1998).

Parental Emotional Expressivity

Parents' emotional expressivity influences children's emotions through multiple ways. First, children may learn to express their own emotions from their parents' modeling. By observing parents' expression of emotions, children gather the

information regarding in what situation what emotion can be expressed in what ways. With such information, children may learn cultural norms of emotional expression. Second, parental expressions of emotions can expose children to a variety of emotions. These exposures can facilitate children's understanding and interpretation of others' emotions, which are crucial skills in the social world (Eisenberg et al., 1998). Additionally, parental expressions of emotions may influence children's feelings about themselves, others, and the social world. Parents' direct expression of positive or negative emotions may also influence the global parental warmth, attachment, and the general interactions and relationships between parents and children.

In line with their cultural emphasis on autonomy and independence, parents in Western cultures tend to encourage their children's expression of emotions, and often do so through modeling, in which they express their own emotions in appropriate situations. Through parents' modeling, children learn important knowledge about situations that elicit various emotions as well as skills to regulate emotions. It has been shown that parents' emotional expressivity promotes children's general emotional competence (Halberstadt, Fox, & Jones, 1993; Valiente et al., 2004), whereas parents' lack of emotional expressivity impedes children's emotional expression and emotion knowledge (Suveg, Zeman, Flannery-Schroeder, & Cassano, 2005). In contrast, given that emotion expression is considered disruptive to group harmony in East Asian cultures, parents in such cultures may express their own emotions less frequently.

Cross-cultural studies have shown cultural variations in parental emotional expressivity. With a self-report measurement called Self-Expressiveness in the Family Questionnaire (SEFQ; Halberstadt, Cassidy, Stifter, Parke, & Fox, 1995), researchers found that European American mothers reported more positive expressivity than Indian American mothers and Chinese mothers, although there was no difference in mothers' expressivity of negative emotions (Camras, Kolmodin, & Chen, 2008; McCord & Raval, 2016). The cultural differences in parental emotional expressivity may be shaped by cultural values held by parents. In support of this argument, S. H. Chen and colleagues found that Chinese immigrant parents' emotional expressivity was related to their cultural orientation (S. H. Chen, Zhou, Main, & Lee, 2015), such that their orientation to American culture was positively associated with their emotional expressivity, whereas their orientation to Chinese culture was negatively associated with their emotional expressivity.

In addition to results from self-report, observations of parents' emotional expressivity during parent-child interactions showed similar cultural differences. For example, Liu and colleagues examined mothers' emotional expressivity during face-to-face interactions with their 4-month-old infants in European American and Chinese immigrant families. They found that European American mothers spent more time displaying positive affect and less time expressing neutral or negative affect than did Chinese immigrant mothers who recently immigrated to the USA. However, second-generation Chinese immigrant mothers or those who had immigrated to the USA more than 10 years had similar patterns of emotional expressivity as European American mothers (C. H. Liu, Yang, Fang, Snidman, & Tronick, 2013). Similarly, when mothers interacted with their preschool-aged children, European American mothers displayed more positive facial and vocal expressions and fewer negative vocal expressions than did first-generation Chinese immigrant mothers (Song, Yang, & Wang, 2016).

Culture further influences the impact of parental emotional expressivity on children's development. For example, European American mothers' positive expressivity was found to be related to adaptive child outcomes and their negative expressivity was unrelated to child outcomes. In contrast, Indonesian mothers' positive expressivity was unrelated to child outcomes and their negative-submissive emotional expressivity was related to maladaptive child outcomes such as behavioral problems and poor social competence (Eisenberg, Liew, & Pidada, 2001; McCord & Raval, 2016). Across cultures, maternal negative-dominant

emotional expression was associated with children's maladaptive outcomes such as low emotion regulation, low sympathy, low popularity, and more externalizing problems (S. H. Chen, Zhou, Eisenberg, Valiente, & Wang, 2011; S. H. Chen et al., 2015; Eisenberg et al., 2001; McCord & Raval, 2016). In addition, S. H. Chen et al. (2015) found that, similar as European American mothers, Chinese mothers' positive expressivity predicted their children's lower externalizing problems and higher social competence. Song et al. (2016) further observed that different forms of emotional expressivity had differential effects on children from different cultural backgrounds. Specifically, maternal facially expressed positive emotions were facilitative to European American children's emotion understanding, whereas maternal vocally expressed positive emotions were facilitative to Chinese immigrant children's emotion understanding. Thus, culture not only influences parental emotional expressivity but also moderates the relation between parental emotional expressivity and child well-being outcomes.

Parent-Child Conversation About Emotions

Another important practice for socializing children's emotions is emotional conversations. Discussion about emotional states or other internal states, and the causes and consequences of these emotional states, can help children reflect on their own emotions and try to interpret others' emotions. Such reflections can make emotional states more explicit and facilitate children's expression, understanding, and regulation of their emotions (Denham, Zoller, & Couchoud, 1994; Garner, Jones, Gaddy, & Rennie, 1997). Discussion about emotional experiences between parents and children further helps children learn knowledge about emotional expressions, situations, and causes (Denham, Renwick-DeBardi, & Hewes, 1994; Dunn, Brown, & Beardsall, 1991; Dunn, Slomkowski, Donelan, & Herrera, 1995). In contrast, other conversations, such as discussion about behaviors, may draw children's attention outward, so may hinder children's emotion understanding.

Parents differ in the frequency and manner in which they engage their children in emotional conversations. In line with their cultural values, parents in Western cultures often explicitly teach, share, and discuss emotions with their children (i.e., emotion coaching) (Gottman, Katz, & Hooven, 1997). Emotion coaching usually consists of helping the child label an emotion, explicitly explaining an emotion and its relation to a situation or event, and teaching the child about strategies to deal with an emotion (Denham et al., 2007; Gottman et al., 1997). Discussion of emotion and emotion-relevant conversation is central to emotion coaching (Eisenberg et al., 1998). In Western culture, parental coaching is considered constructive, and fosters children's ability to understand and regulate emotions (Gottman et al., 1997). In East Asian and other cultures where a great emphasis is placed on group harmony, hierarchical relationships, and interdependence (Matsumoto, 1991), and where emotional expression is considered disruptive to group harmony (Q. Wang, 2003), parents tend not to frequently talk about causes and consequences of emotions with their children. Instead, they teach children emotion display rules, promote sensitivity to others' emotions, and emphasize proper behavioral conduct (Chan, Bowes, & Wyver, 2009; Doan & Wang, 2010; Q. Wang, 2001, 2013a; Q. Wang & Fivush, 2005). As a result, European American mothers more frequently explain, elaborate, and negotiate about emotions, and talk about internal states more often during their conversations with their preschool-aged children, compared to Chinese or Chinese immigrant mothers (Doan & Wang, 2010; Fivush & Wang, 2005; Q. Wang, 2001). On the other hand, Chinese immigrant mothers make more references to behaviors than European American mothers when telling a story with their preschoolers (Doan & Wang, 2010).

Interestingly, when talking about a past event with their school-aged children, Chinese immigrant mothers' references to internal states did not differ from those of European American mothers (Yang, Koh, & Wang, 2017). The result might reflect acculturation of this group of Chinese immigrant mothers who had lived in the

USA for a longer period of time and might thus have been acculturated to American culture to a greater extent. In support of this hypothesis, Tao and colleagues found that cultural orientation played a role in the patterns of mother-child conversations. Immigrant mothers' orientation toward Chinese culture was negatively associated with their emotion questions, emotion explanations, and quality of emotion talk, whereas their orientation to American culture was positively associated with maternal use of positive emotion words and emotion explanations (Tao, Zhou, Lau, & Liu, 2013).

However, when directly comparing Chinese immigrant mothers in the USA and Chinese mothers in China, Q. Wang (2013a) found that Chinese immigrant mothers' conversations with their preschool children were more consistent with traditional Chinese values than Chinese mothers in China. For example, Chinese immigrant mothers attributed fewer emotions to their children and provided fewer explanations of emotions than did Chinese mothers in China. Q. Wang suggested that Chinese immigrant mothers may actively preserve traditional Chinese cultural values, whereas mothers in modern cities like Beijing are shifting their cultural values in the process of modernization. A more complex picture emerged from findings such as second-generation Mexican American mothers used more emotion labels but fewer emotion explanations than did first-generation Mexican mothers (Cervantes, 2002), and African American fathers referred to more negative emotions than did non-African American fathers (Garrett-Peters, Mills-Koonce, Zerwas, Cox, & Vernon-Feagans, 2011). In addition, both European American and Chinese mothers of girls made more emotion attributions and explanations than those of boys (Q. Wang, 2001, 2013a). Additional studies are needed to investigate the role of migration status and acculturation process in parent-child emotional conversations.

Parent-child conversations about emotion have consequences for children's emotional development across cultures. Doan and Wang (2010) found that whereas maternal discussion about internal states was positively associated with emotion understanding, maternal references to behaviors were negatively associated with emotion understanding in both European American and Chinese immigrant children. Interestingly, talking about specific aspects of internal states, such as desires, cognition, and emotional states, had different effects on emotion understanding in school-aged children. Yang, Koh, & Wang (2017) observed that for both European American and Chinese immigrant families, maternal references to cognition (e.g., knowledge and thoughts) and emotional states positively predicted children's emotion understanding 6 months later. In contrast, maternal references to desires and opinions negatively predicted children's emotion understanding. Research in other cultures has provided additional evidence for the influence of parent-child conversations on children's emotional development. Aznar and Tenenbaum (2013) found that Spanish mothers' emotion labels during storytelling were positively associated with their preschoolers' emotion understanding 6 months later, after controlling for children's previous emotion understanding. Similarly, Japanese mothers' questioning, clarifying, and referring to children's emotions during storytelling and reminiscence of emotional experience predicted preschoolers' emotion understanding (Watanabe, 2015).

Additionally, ethnicity identity influences how parents carry out conversations with their children, which, in turn, influences children's understanding of emotion situations. In a study with a group of Pacific Island families living in New Zealand, Taumoepeau (2015) examined caregivers' ethnic identity and their use of mental states language when talking with their children at 15, 20, 26, 33, and 39 months. Children's emotion situation knowledge was assessed at 39 months. Taumoepeau found that caregivers' strength of ethnic identity was positively correlated with their acceleration rate of cognitive talk over time, which in turn positively predicted children's emotion situation knowledge at 39 months. Thus, although family emotional conversations generally facilitate emotional development, the effects are sometimes moderated by culture and cultural identification as well as specific characteristics of the conversations.

Parental Reactions to Children's Emotions

By ways of reacting to children's emotions, especially negative emotions, parents are showing children what emotions are appropriate or inappropriate to express in a certain situation. Some parental reactions have been considered supportive, such as helping children solve the problem (problem-focused reactions), comforting children (emotion-focused reactions), and encouraging children to express their emotions (emotion expressive encouragement). Other parental reactions are considered relatively non-supportive, such as minimizing the significance of children's emotions (minimization) and punishing children's negative emotions (punitive reactions) (Fabes, Poulin, Eisenberg, & Madden-Derdich, 2002). Fabes and his colleagues suggest that, when parents use supportive reactions, children are less likely to be over-aroused in stressful situations and thus better able to process parents' coaching for the management of their emotions and behaviors. As a result, children are more likely to learn appropriate strategies for regulating their emotions and emotionally driven behaviors (Fabes, Eisenberg, & Eisenbud, 1993; Fabes, Leonard, Kupanoff, & Martin, 2001). In contrast, parents with non-supportive reactions intend to control or change their children's emotions rather than seizing the opportunity to teach children emotion-management skills (Gottman et al., 1997). Consequently, children whose parents restrict their emotional expressions learn to suppress their expressions, while exhibiting high physiological arousal in emotionally evocative situations previously associated with punishment (Buck, 1984; Gross & Levenson, 1993). The suppressed emotions often remain unresolved and increase in intensity over time, which may become evoked in the next stressful situation and contribute to children's difficulty in emotion regulation (Buck, 1984). Thus, supportive reactions are preferred practices among Western mothers than non-supportive reactions. However, parents in Asian cultures have a less strong preference for supportive reactions than European American parents. For example, Chinese mothers have similar preferences for minimizing children's negative emotions and encouraging children's emotional expressions (Chan et al., 2009; Tao, Zhou, & Wang, 2010).

Studies involving cross-cultural comparisons have shown that parents from Western countries tend to use supportive reactions more often and use non-supportive reactions less often than parents from non-Western countries. For example, American mothers of school-aged children, adolescents, and emerging adults reported using more problem-focused reactions and emotion expressive encouragement than Indian mothers (Karkhanis & Winsler, 2016; Raval, Raval, Salvina, Wilson, & Writer, 2013). In contrast, Indian mothers reported using more non-supportive reactions (punitive, minimizing, scolding, and dismissing) than American mothers (Karkhanis & Winsler, 2016; Teo, Raval, & Jansari, 2017). European American mothers reported similar levels of supportive reactions as did Chinese immigrant mothers but fewer non-supportive reactions (Yang, Song, Doan, & Wang, in press). Latino mothers were observed to minimize or not respond to their preschoolers' negative affect more often than European American mothers (Lugo-Candelas, Harvey, & Breaux, 2015). Korean and Asian American parents endorsed more emotion suppression and shaming when responding to their children's positive and negative emotions (Louie, Oh, & Lau, 2013). There are also within culture variations. Raval and Martini (2009) found that Indian mothers from an old city reported using more minimizing and punitive reactions than mothers from suburban India. These cultural differences in parental reactions to children's negative emotions may reflect parental socialization goals. In a qualitative study, Fishman et al. (2014) observed a unique overarching philosophy across Indian immigrant mothers, who believed that negative emotions were inevitable and that the most practical reaction would be to move on with one's life (Fishman, Raval, Daga, & Raj, 2014). Some of the non-supportive reactions to negative emotions, such as minimizing, may be particularly useful for helping children move on.

Parental reactions to children's emotions also depend on the specific emotions that children are expressing. For example, in a study with European American, Turkish, and Romanian

mothers of 2-year-old children, mothers reported their responses to children's anger, sadness, fear, and happiness (Corapci et al., 2017). To children's anger, Romanian and Turkish mothers reported more reasoning and comforting responses and fewer behaviorally oriented disciplines than European American mothers. However, mothers from the three cultural groups reported the same level of problem-focused reactions to teach children coping skills. To sadness, mothers of all cultures endorsed problem-focused and comforting responses at the same rate. To fear, Turkish and Romanian mothers emphasized reasoning more than European American mothers, who reported more comforting reactions. To happiness, European American mothers reported validating their children's happiness more often than did Turkish and Romanian mothers. These findings highlight the importance of examining individual emotions when studying parents' reactions to children's emotional expressions.

Culture further moderates the relation between parental reactions to children's emotions and children's social-emotional outcomes. In general, in Western families, parental supportive reactions were associated with children's positive outcomes, such as emotion understanding and social competence, whereas parental non-supportive reactions were related to children's maladaptive outcomes, such as behavioral problems and maladaptive coping strategies (Eisenberg et al., 1999; Fabes et al., 2002). However, these effects are less clear in other cultures. For example, while European American mothers' problem-focused responses were positively associated with children's academic performance and social competence, African American mothers' expressive encouragement was negatively correlated with children's academic performance and social competence (Nelson et al., 2013), and Indian mothers' expressive encouragement was positively correlated with emerging adults' adjustment problems (Teo et al., 2017). In Asian families with younger children, maternal supportive or accepting reactions were positively associated with children's emotion understanding and social functioning in Chinese and Korean families (Kim & Kim, 2012; Lee & Chung, 2002; Yang et al., in press), whereas non-supportive reactions of Indian and Chinese immigrant mothers were not related to their children's outcomes (McCord & Raval, 2016; Yang et al., in press). Similarly, Louie et al. (2013) found that parental control, such as suppressing and shaming children's emotions, was positively related to European American preschoolers' expression of anger and exuberance in emotion-eliciting tasks, but parental control was not related to Asian American or Korean children's emotional expressivity during the tasks.

Cultural similarities in the relation between parental reactions and children's emotional outcomes have also been observed. For example, parental supportive reactions, such as emotion coaching, were positively correlated with adaptive behaviors in both Chinese immigrant children and European American children (Yang et al., in press) and negatively correlated with depressive symptoms in both African American children and European American children (Bowie et al., 2013). Maternal non-supportive reactions also had negative effects on Indian children's psychological adjustment (Teo, et al., 2017), similar as in Western children. Tao, Zhou, and Wang (2010) found that, similar to European American mothers, mainland Chinese mothers' punitive reactions positively predicted children's later externalizing problems, while their emotion-focused and problem-focused responses negatively predicted children's behavioral problems.

The relation between parental reactions to children's emotions and child outcomes can be further affected by factors such as parental socialization goals and the valence of children's emotions. Raval et al. (2017) observed that Chinese and Indian mothers' relational socialization goals influenced their supportive reactions, which, in turn, had consequences for children's emotion regulation and internalizing problems. On the other hand, maternal non-supportive responses affected children's externalizing problems through child emotion dysregulation (Raval, Li, Deo, & Hu, 2017). In a study among Korean preschoolers and their parents, Lee and colleagues found that maternal supportive reactions (e.g., accepting) to children's negative emotions and maternal non-supportive reactions (e.g., controlling) to children's positive emotional

expressions were both negatively correlated with children's behavioral problems. Maternal controlling reactions to children's positive emotions moderated the relations between children's emotion understanding and social functioning, whereby emotion understanding played a protective role in children's social functioning only for children whose parents used more controlling reactions to children's positive emotions (Lee, Eoh, Jeong, & Park, 2017). Thus, how parental reactions to children's emotions affect children's social and emotional development depends on culture, the specific reaction, the valence of children's emotions, and also the specific emotions.

Children's Emotional Development Across Cultures

The different emotion socialization goals and practices across cultures may have important consequences for emotional development. Although cross-cultural studies on emotional development are still relatively scarce, important differences have been found in children's temperament, emotional expression and experience, emotion recognition, emotion knowledge, emotion regulation, and emotional well-being.

Temperament

Temperament, including reactivity, emotionality, and self-regulation, is influenced by heredity, maturation, and experience (Rothbart & Derryberry, 1981). Although temperament may change in development, it usually shows stability over time and consistency across situations (Rothbart & Bates, 2006). The biological basis of individual differences in temperament is often emphasized, but temperament may also be influenced by social norms, cultural values, and the perception or evaluation of certain temperament type of a community in which the child grows up.

Cross-cultural observations revealed that although Chinese infants were less active, irritable, and vocal than American infants (Kagan et al., 1994), the early temperament appears to be shaped by later culture experiences such that Chinese, as well as Korean, toddlers came to have more fearful and anxious reactions in unfamiliar situations than did Australian and Italian toddlers (Rubin et al., 2006). However, parent-reported data yielded mixed results. Compared to American infants, Chinese infants were rated by their parents as more reactive in some studies (Gartstein et al., 2006; Porter et al., 2005), but as less reactive in another study (Hsu, Soong, Stigler, Hong, & Liang, 1981). Asian mothers rated their infants as more intense, more negative in mood, and rated their school-aged children as more shy-anxious and more fearful than did American mothers (Ahadi, Rothbart, & Ye, 1993; Gartstein et al., 2006; Hsu et al., 1981; Porter et al., 2005). Self-reported data showed that, compared with European American children, Chinese American, Japanese American, and Filipino American children and adolescents had greater anxiety and fear (Austin & Chorpita, 2004), and Indian adolescents had a higher level of negative affect (Karkhanis & Winsler, 2016). Japanese and Russian children tended to score higher on fearfulness than Americans, who scored higher than Finnish (Gaias et al., 2012; Gartstein, Slobodskaya, Żylicz, Gosztyła, & Nakagawa, 2010). Finnish individuals across all ages (from infancy to adulthood) were rated higher on positive affect and effortful control than Americans, whereas American infants' scores on positive affectivity, high-intensity pleasure, approach, and vocal reactivity were higher than those of Russians and Japanese (Gaias et al., 2012; Gartstein et al., 2010).

Children's self-control capacity, as one aspect of temperament, is also shaped by cultural contexts. Cultural values of group harmony and behavioral inhibition may facilitate the early socialization of children's self-control (Ho, 1986). Consistent with this notion, Chinese toddlers showed greater self-control abilities, such as waiting for a longer time and demonstrating more compliant behaviors, than Canadian toddlers (X. Chen, DeSouza, Chen, & Wang, 2006). In addition, Chinese and Korean preschoolers performed better on executive function tasks assessing self-control abilities (Oh & Lewis, 2008; Sabbagh, Xu, Carlson, Moses, & Lee, 2006).

It cannot be completely ruled out that biological factors may play a role in the cultural differences in temperament. Some studies found that Japanese and Chinese children and adults differed from their European American counterparts in biological measures often associated with reactivity in Western populations, such as cortisol reactivity, serotonin transporter genetic polymorphisms (5-HTTLPRR), heart rate, and heart rate variability in stressful situations (Kagan, Kearsley, & Zelazo, 1978; Tsai, Hong, & Cheng, 2002). However, it is unknown whether these biological measures are similarly related to temperament among Asians. The biological contributions to cultural differences in temperament thus remain unclear.

Culture further moderates the relations between children's temperament and their other aspects of social and emotional development. For example, a study with Russian and American toddlers showed that a higher level of negative affectivity or a lower level of soothability was associated with internalizing problems for American children but not for Russian children (Gartstein, Slobodskaya, Kirchhoff, & Putnam, 2013). For Asian children, their negativity in preschool was even positively correlated with their social competence at kindergarten (Rispoli, 2011). Additionally, while there was a positive correlation between extraversion and happiness for both American and Indian children, emotionality was negatively correlated with happiness for American children, but not for Indian children (Holder, Coleman, & Singh, 2012).

Emotional Expression and Experience

Children's emotional expression and experience vary across cultures in line with their cultural values and emotion socialization practices. Japanese children were observed to express anger less frequently than American children across different contexts of assessment (Zahn-Waxler, Friedman, Cole, Mizuta, & Hiruma, 1996). Japanese infants showed fewer emotional responses to a routine inoculation than did European American infants (Lewis, Ramsay, & Kawakami, 1993). Low emotional expressivity is particularly evident in Chinese infants, whereby Chinese infants were found to be less emotionally expressive than European American as well as Japanese infants (Camras et al., 1998). In other studies, Korean, Asian American, and European American preschoolers took part in several emotion-eliciting tasks, and their positive and negative emotional expressions were observed. Results showed that Korean children and Asian American children expressed sadness, happiness, and anger less frequently than European American children during the tasks (Louie, Oh, & Lau, 2013; Louie, Wang, Fung, & Lau, 2015). In a study where preschoolers were asked to create a happy song and a sad song, Japanese preschoolers used fewer emotion words or emotion-evoking events in their songs than did their Canadian counterparts (Adachi & Trehub, 2011). In general, East Asian children experience or express emotions less frequently than European American children. Interestingly, 6-year-old Chilean children reported higher levels of sympathy than Swiss children (Chaparro, Kim, Fernández, & Malti, 2013), and Japanese toddlers tended to experience more shame but less pride than American toddlers (Furukawa, 2005). More cross-cultural research is needed to examine the development of moral emotions and self-conscious emotions.

Furthermore, children from different cultures may express their emotions differently depending on the situation and audience (Novin, Rieffe, & Mo, 2010). In one study, South Korean children and Dutch children were asked, "How would you feel" and "What would you say?" in response to 8 scenarios where negative emotions were elicited (Novin et al., 2010). The "audience" was the father in some scenarios, and a peer in others. There was no cultural difference in children's emotional experiences (i.e., answers to "How would you feel?"). However, there was an interaction between culture and situation on children's emotional expressions (i.e., answers to "What would you say?"). South Korean children reported more prosocial and fewer aggressive emotional reactions than Dutch children in the father situations, but there was no cultural difference in emotional reactions in the peer situations. Compared with Dutch children, South Korean children might be more aware of the hierarchy and authority, which further influenced their

responses in emotion-eliciting situations with the presence of the father.

In addition to parental emotion socialization, exposure to cultural messages through channels such as the media or books can also influence children's emotional expression and experiences. Tsai et al. (2007) found that the best-selling storybooks in the USA contained more excited expressions, wider smiles, and fewer calm expressions than the best-selling storybooks in Taiwan. Across these two cultures, exposure to excited emotion expressions increased children's preferences for exciting activities (Tsai, Louie, Chen, & Uchida, 2007). Similarly, Wege et al. (2014) examined storybooks for preschoolers in Romania, Turkey, and the USA. They found that Romanian books contained fewer positive emotions than American and Turkish books. Whereas American books contained an equal number of negative powerless (e.g., sadness) and negative powerful (e.g., anger) emotions, Romanian and Turkish books had more negative powerless emotions than negative powerful emotions (Wege et al., 2014).

Culture further moderates the relations between children's emotional expression and other aspects of social and emotional development. For instance, children's emotional expressivity was negatively related to teacher-reported social competence for Asian American and Korean children, but not for European American children. Furthermore, the expressions of sadness and happiness were positively correlated with antisocial behaviors for Korean children, and the expression of anger was negatively associated with Asian American children's peer acceptance and prosocial behaviors. Yet these relations were not significant for European American children (Louie et al., 2015). It appears that, in line with their cultural emphasis on moderation in emotional experience and expression (Markus & Kitayama, 1991; Q. Wang, 2013b), Asian children who express emotions frequently tend to have worse psychological adjustment.

Emotion Recognition

There is some evidence that Asian children outperform Western children on emotion recognition tasks. In a study by Markham and Wang (1996), Chinese and Australian 4-, 6-, and 8-year-old children saw facial expressions of six basic emotions (i.e., happiness, sadness, fear, anger, disgust, and surprise) and were asked to label them or give example situations. Chinese children performed better than Australian children on the recognition of all emotions except happiness (Markham & Wang, 1996). Markham and Wang (1996) suggested that Chinese children's higher accuracy of emotion recognition may stem from culturally shaped emotion socialization. The Chinese cultural emphasis on group harmony encourages individuals to be sensitive to others' emotional expressions. This is often reflected in family emotion socialization (Q. Wang, 2013b; Q. Wang & Fivush, 2005), which may further facilitate Chinese children's ability to recognize emotions. Similarly, Chinese children attended to mood in pictures at an earlier age than American children (Jolley, Zhi, & Thomas, 1998).

Very little cross-cultural research has been done on emotion recognition from auditory cues. In a study conducted in Canada and Japan, children and adults from both cultures listened to songs sung by Canadian school-aged children and rated how happy or sad each song sounded (Adachi, Trehub, & Abe, 2004). In both cultures, children and adults recognized the intended emotions in the songs, and children indeed showed higher accuracy than did adults presumably because the songs were sung by children. Furthermore, Canadian children rated happy songs more accurately than sad songs, whereas Japanese children rated sad songs more accurately than happy songs. However, given that Japanese children listened to foreign songs sung in English, the results might not reveal their real ability to detect emotional cues from auditory information. Yang, Wang, and Wang (2017) conducted a study to examine Chinese and European American children's sensitivity to vocal tones and semantic contents in spoken words. They found that, when listening to spoken words with contrasting vocal tones and word meanings, Chinese children paid more spontaneous attention to vocal tones and less attention to semantic contents than their European American counter-

parts. It appears that Chinese children were more sensitive to emotional cues in vocal tones than American children, who were more attuned to emotions conveyed in semantic content during communication.

Cultural differences have also emerged in the recognition of different emotions. In a study, Canadian 5- to 10-year-old children were asked to judge basic emotions expressed on Caucasian and Asian adult faces. Whereas children categorized expressions of fear and surprise better from Asian than Caucasian faces, they categorized expressions of disgust better from Caucasian than Asian faces (Gosselin & Larocque, 2000). In addition, studies in Western cultures showed that Italian school-aged children and adolescents scored higher on emotion recognition than did their Finnish and American counterparts (Rosenqvist et al., 2017). In a study that examined how children's emotion recognition was influenced by contextual factors, Ishii, Rule and Toriyama (2017) found that Japanese preschoolers were more likely than Canadians to judge a neutral facial expression as negative (positive) when the surrounding facial expressions were negative (positive). In contrast, Canadian children were more likely than Japanese to judge a neutral emotion as negative (positive) if the surrounding emotions were positive (negative). Contextual information thus influences children's emotion judgment differently for children from different cultural backgrounds: Whereas contextual information had an assimilation effect for Japanese children, it had a contrast effect for Canadian children. In another study that examined preschoolers' ability to recognize emotions from nonverbal vocal cues in content-free speech tapes, Matsumoto and Kishimoto (1983) found that American preschoolers were only able to recognize surprise, whereas Japanese preschoolers could recognize both surprise and sadness. However, by age 6, American children were able to correctly recognize all four emotions – happiness, surprise, sadness, and anger – whereas Japanese children could only correctly identify surprise, sadness, and happiness and couldn't recognize anger until 7 years of age.

Emotion Knowledge

The development of knowledge about emotion situations is also shaped by cultural values and related socialization practices (Q. Wang, 2006). In studies with an emotion judgment task, Chinese and European American preschoolers and kindergarteners were presented with short stories in which the protagonist experienced discrete emotions (with his or her facial expressions concealed). Children were asked to judge what emotion the protagonist experienced in each story. Chinese children across different age groups performed poorer on this task than European American children (Q. Wang, 2003; Q. Wang, Hutt, Kulkofsky, McDermott, & Wei, 2006). Similarly, in studies using an emotion production task in which children were asked to describe situations that could elicit certain emotions, Chinese and Chinese American preschoolers scored lower than European Americans (Doan & Wang, 2010; Q. Wang, 2008; Q. Wang et al., 2006). These cultural differences in children's emotion knowledge are in line with family emotion socialization practices, where European American mothers frequently discuss and explain emotions to facilitate their children's emotion understanding and Chinese mothers focus on behavioral expectations and moral lessons in their conversations with children (Doan & Wang, 2010; Q. Wang, 2001; Q. Wang & Fivush, 2005).

Interestingly, when they grow older into middle childhood, Asian children seem to be catching up on their emotion knowledge. Yang and Wang (2016) found that, at age 8, Chinese American children had the same level of emotion knowledge as their European American counterparts. This may stem from the acculturation of Chinese immigrant children as they become increasingly immersed in the mainstream culture at school and other settings outside home. The change of cultural differences in children's emotion knowledge within the USA suggests that both home culture and host culture may play roles in children's development of emotion understanding, and they may be dominant in different

developmental stages. When children are young they primarily interact with their parents at home and are socialized by their parents with the cultural values from their home culture. However, after children enter schools in the USA, they are immersed in the host culture (American culture for Chinese American children) and interact more often with peers and teachers from the host culture. Therefore, children may be influenced by their host culture to a greater extent in middle childhood or later.

Additionally, cultural differences in emotion knowledge may depend on the particular emotions and situations. D. Chen (2009) found that Chinese children understood shame and pride earlier than did American children in hypothetical scenarios in which desires and rules conflicted (D. Chen, 2009). Consistently, 8-year-old Chinese American children described more situations that could elicit pride than did European American children (Yang & Wang, 2016). The agent of emotion also matters. When telling stories about hypothetical situations, Chinese children attributed more emotions to story characters than did European American children (Q. Wang & Leichtman, 2000). In contrast, when talking about their own experiences, European American children more frequently discussed their own emotions and other internal states than did Chinese children (Q. Wang, 2004). This is consistent with different emotion socialization practices in which Chinese parents frequently encourage their children's attentiveness and sensitivity to others' emotions, whereas European American parents frequently encourage their children to attend to their own feelings and desires (Q. Wang, 2013a; Q. Wang & Fivush, 2005). There is also some evidence for cultural differences in the knowledge of emotional intensity. Q. Wang (2003) found that, like their mothers and other adults in their respective cultures, Chinese children attributed less intense negative emotions to story characters than did European American children. Chinese children also attributed less intense positive emotions to story characters than did European American children, although adults in the two cultures did not differ.

Emotion Regulation

Children from different cultures may develop different emotion regulation strategies as a result of their parents' values about emotions and socialization goals. During the first year of life, infants across cultures often sooth themselves by sucking, and parents across cultures often use infant-directed speech, touching, and singing play songs and lullabies to reduce infants' distress and negative emotions (de l'Etoile, 2006; Lowe et al., 2016; Nakata & Trehub, 2004). Nevertheless, there are cultural differences such as Hispanic mothers in the USA used more attention-seeking touch and less nurturing and accompaniment touch than Ecuadorian mothers when interacting with their infants (Lowe et al., 2016). Compared to German mothers, Cameroonian Nso mothers considered breastfeeding to be especially important to regulate their infants' negative emotions and also prevent infants from crying (Keller & Otto, 2009). The Nso mothers also used directives to suppress their infants' negative emotions more often than German mothers, who tended to determine the reason for crying by asking questions before they act (Keller & Otto, 2009). Additionally, Cameroonian Nso and Costa Rican mothers kept body contact (e.g., holding, sitting, lap, and close proximity within arm length) and used body stimulation (e.g., vestibular, kinesthetic, motor, or tactile stimulations, and upright holding) more often, but had eye-to-eye contact less frequently than did Greek and German mothers (Keller et al., 2004). In a study using face-to-face-still-face paradigm, Chinese American and European American mothers' interactions with their 4-month-old infants were observed in free play sessions before the stress induced by mothers' still face and also after the still face stress (C. H. Liu et al., 2013). First-generation Chinese American mothers increased their content-based vocalization and singing/rhyming from prestress play to poststress play to regulate their infants' distress, whereas there was no increase of such strategies for European American mothers from prestress to poststress sessions. Parents in different cultures tend to use different strategies to regulate their infants' emotions to achieve their

socialization goals: Whereas Western parents try to use questions and eye contacts to socialize infants' autonomy and independence, non-Western parents often keep close proximity and body stimulation to downregulate infants' negative emotions to socialize their relatedness and obedience.

Cultural differences in emotion regulation have emerged in toddlerhood. In one study, Japanese and German toddler girls witnessed a playmate's distress in a lab room with the presence of their mothers (Friedlmeier & Trommsdorff, 1999). Their emotional reactions to the distress, regulatory behaviors, and the end state of their emotions were observed. Japanese toddlers were more likely than German toddlers to display a distress reaction. When trying to regulate their distress, Japanese toddlers displayed more negative emotion regulation (e.g., lack of eye contact, emotion suppression, and tension at the end) and less positive emotion regulation (e.g., support seeking with eye contact and relaxing at the end) than did German toddlers. Consequently, more German than Japanese toddlers were able to be relaxed at the end. These results are consistent with the findings that Asian children show higher reactivity to distress (Gartstein et al., 2006; Porter et al., 2005) and that Asian adults are more likely to suppress their emotions, when compared with Westerners. In a study that observed toddlers' emotion regulation strategies when they were restraint from getting a toy (Bozicevic et al., 2016), British toddlers from Reading used more distraction strategies and fewer self-soothing strategies than South African toddlers. South African toddlers from Stellenbosch were the least likely to use avoidance than British toddlers and South African toddlers from Khayelitsha (Bozicevic et al., 2016).

Cultural differences in emotion regulation become more evident by the preschool age. J. Wang (2013) observed Chinese and American preschoolers (3–3.5 years old) in two emotionally challenging situations: resistance to temptation and breaking someone's toy. Chinese children were less expressive of happiness and sadness than American children. Moreover, Chinese children showed a cumulative pattern of anger response across contexts. Chinese children further displayed more emotion-focused self-regulatory behaviors, such as focal avoidance and self-soothing, but fewer context-directed distraction behaviors, when compared with American children (J. Wang, 2013). Similarly, Japanese preschoolers showed less anger and less under-regulation of emotion than American children when responding to hypothetical interpersonal dilemmas (Zahn-Waxler et al., 1996). These differences in children's emotion regulation reflect respective cultural values and socialization practices: There is a greater emphasis in Asian cultures on emotion suppression and self-regulation to maintain group harmony, and there is a greater emphasis in Western cultures on self-assertion and taking control of situations to promote autonomy and agency. Culture further influences the contexts in which children are able to regulate their emotions. Japanese 3-year-old girls were able to downregulate their distress in a situation involving self-focused stress but sustained their distress in an other-focused stressful situation. In contrast, German girls remained their distress in the self-focused distress situation but decreased their distress in the other-focused distress situation (Trommsdorff & Friedlmeier, 2010).

Studies with school-aged children and adolescents have yielded consistent findings. Chinese immigrant children were reported by their mothers to use fewer types of coping strategies than their European American counterparts (Yang & Wang, 2016). In stressful situations, German school-aged children were reported to use more anger-oriented emotion regulation strategies (e.g., "I get mad and break something") than Chilean children, but the two cultural groups were equally likely to use problem-focused emotion regulation strategies (Weis, Trommsdorff, & Muñoz, 2016). Similar to findings among adults in cultures high on social order and hierarchy (Matsumoto, Yoo, Nakagawa, et al., 2008), there was a positive correlation between reappraisal and suppression emotion regulation strategies among Taiwanese adolescents, but only for males (Yeh, Bedford, Wu, Wang, & Yen, 2017). In addition, Taiwanese adolescents' suppression strategies were positively correlated with their negative emotions and internalizing problems, while reappraisal strategies were negatively correlated with

female Taiwanese adolescents' internalizing problems. Reappraisal strategies buffered the negative effects of suppression on negative emotions and internalizing problems for male Taiwanese adolescents, but not for females. Adolescents from different cultures also show similarities and differences when regulating different emotions. For instance, in Wan and Savina's study, European American and Hong Kong Chinese adolescents were asked to rate the effectiveness of various strategies for regulating sadness, anger, and fear in given scenarios. Both European American and Chinese adolescents considered situation avoidance to be most effective for dealing with anger. European American adolescents rated talking to someone and positive thinking as more effective for coping with all emotions than did Chinese adolescents (Wan & Savina, 2016).

Culture further moderates the effect of children's cognitive skills on their emotion regulation. Grabell et al. (2015) found that, to an interpersonal stressor, American and Chinese preschoolers showed the same pattern of biological emotional responses (i.e., cortisol levels). For American children, their inhibitory control was associated with their lower level of cortisol reactivity to an interpersonal stressor, and also related to a faster return to the baseline level of cortisol after the stressful event (Grabell et al., 2015). In other words, American children with better inhibitory control exhibited a faster physiological process of emotion regulation. However, this association was not present in Chinese children. Instead, Chinese children's mother-rated attentional focus was associated with their higher levels of cortisol reactivity. Chinese children may be socialized by their parents to inhibit their emotions, especially in an interpersonal context. It appears that a stressful situation elicited self-control and increased cortisol level in Chinese children due to their greater attentional focus on such a situation.

Emotional Well-Being

Internalizing and externalizing problems are common issues among children and adolescents regarding emotional well-being. Internalizing problems are characterized by a core disturbance in intropunitive emotions, such as depression and anxiety. Externalizing problems signify the behaviors that are disruptive and harmful to others, such as aggression and conduct problems. Most cultural research on internalizing and externalizing problems has focused on adolescents from different ethnic groups in the USA, although there are a few studies examining children's internalizing and externalizing problems in different countries.

A study conducted with children and adolescents, aged 6 through 17 years, from 12 countries or regions revealed the effects of age, culture, and gender on internalizing and externalizing problems (Crijnen, Achenbach, & Verhulst, 1997). Greek and Puerto Rican children and adolescents scored higher on both externalizing and internalizing problems than the overall means across countries, whereas Swedish, German, Dutch, Australian, and Israeli children and adolescents scored lower than the means. American children scored above the mean for externalizing behaviors, whereas Jamaican children scored above the mean and Israeli children scored below the mean for internalizing problems. Boys scored higher for externalizing problems but lower for internalizing problems than did girls. In all countries, externalizing problems decreased with age, while internalizing problems increased (Crijnen et al., 1997). A study with school-aged children in three European countries, Romania, Russia, and France, showed that French children reported more depressive symptoms than did Romanian and Russian children (Gherasim, Brumariu, & Alim, 2017). In addition, compared with European American and Asian American children, Korean preschoolers were reported by their teachers to have more antisocial behaviors (Louie et al., 2015). Japanese and Thai children had more internalizing problems such as depressive symptoms (Weisz et al., 1987) but less delinquency than children from the USA (Kawabata, Crick, & Hamaguchi, 2010). Japanese adolescents reported fewer anxiety symptoms than British adolescents (Essau et al., 2011). British toddlers were reported to have a lower level of aggressive behaviors than two groups of South

African toddlers (Bozicevic et al., 2016). Indian adolescents were reported to have higher level of anxiety than Indian American and Caucasian adolescents (Karkhanis & Winsler, 2016). Thus, the cultural differences in emotional well-being depend on the age of children and the particular cultural background children come from.

Studies conducted within the USA have shown that ethnic minority youth, such as African American, Native American, Latino American, and Asian American adolescents, have higher rates of internalizing problems than do European Americans (see a review Anderson & Mayes, 2010) and are more likely to report higher levels of depression (Brown, Meadows, & Elder, 2007). African American children were reported to have higher levels of negative emotionality at 15 months and delinquency at fifth grade but lower levels of aggression and prosocial behaviors at fifth grade than European American counterparts (Streit, Carlo, Ispa, & Palermo, 2017). Although few adolescents reach clinical levels of depression, internalizing problems put them at risk. The vulnerability to internalizing problems of minority youth may be due to a variety of factors, including biological factors, cultural identity, and perceived discrimination. Racial differences have been found in the distribution of allele frequencies in 5HT transporter gene-liked polymorphic region (Murakami et al., 1999). Japanese adults are less likely than Caucasians to have the long (l) allele that is associated with fewer anxiety-related traits. Race further has an impact on the relations between a certain genotype and the behaviors. The 5-HTTLPR (s) allele was associated with lower scores on neuroticism for African Americans but associated with higher scores on neuroticism for European Americans (Gelernter, Kranzler, Coccaro, Siever, & New, 1998).

The influence of acculturation on ethnic minority youth's emotional well-being is complicated. Some studies have shown a negative impact of acculturation on youth adjustment (Birman & Taylor-Ritzler, 2007). For example, Latino American adolescents with stronger adherence to their heritage culture were less likely to engage in early risky sexual behaviors (Wiesner, Arbona, Capaldi, Kim, & Kaplan, 2015). Japanese adolescents with stronger ethnic cultural identity exhibited lower levels of anxiety (Williams et al., 2002). Korean adolescents' depressive symptoms were positively associated with their acculturation but negatively associated with their Korean identity (Choi, Tan, Yasui, & Pekelnicky, 2014). In addition, first-generation immigrant children identified with their heritage cultures stronger and reported lower levels of anxiety disorder, conduct disorder, and ADD/ADHD, when compared with second-generation immigrant children (Tan, 2016). It is possible that acculturation may disrupt immigrant children's connection to heritage cultures and distance them from social support from their ethnic groups, which might be protective factors especially important for recent immigrants (Birman & Taylor-Ritzler, 2007). Furthermore, children's acculturation may enlarge the cultural gap between parents and children. The discrepancies in acculturation between parents and children are associated with higher levels of internalizing problems and maladjustment in ethnic minority children and adolescents (Céspedes & Huey, 2008; S. H. Chen et al., 2014; Goforth, 2011; Kim, Gonzales, Stroh, & Wang, 2006). This is complicated by the finding that Hispanic American parents' acculturation was related to their children's increased externalizing problems (Ramirez, 2012). In addition, bilingualism may be a protective factor for immigrant youth's emotional well-being. It was found that Korean American adolescents' Korean and English proficiencies were both associated with fewer depressive symptoms (Choi et al., 2014).

On the other hand, there have also been findings that acculturation is related to lower risk for internalizing disorders and suicidality, and to better adjustment among Asian Americans (S. H. Chen et al., 2014; Lau, Jernewall, Zane, & Myers, 2002). One explanation is that Asian adolescents with lower levels of acculturation may uphold more traditional cultural values, which puts them at odds in the mainstream culture. Another explanation is that the interdependence values of traditional Asian cultures may play a negative role in immigrant youth's emotional

well-being. Several studies have shown that among Asian American youth, those with interdependent self-construal have more internalizing problems such as depressive symptoms and psychological distress (Essau et al., 2011; F. F. Liu & Goto, 2007; Norasakkunkit & Kalick, 2002; Okazaki, 1997), whereas those with independent self-construal have fewer anxiety symptoms (Essau et al., 2011). On the other hand, there was a positive association between independent self-construal and delinquency or risky sexual behaviors (Le & Kato, 2006; Le & Stockdale, 2005). In general, Asian American adolescents with more interdependence values tend to have more internalizing problems, such as depression, whereas Asian American adolescents with more independence values tend to have more externalizing problems. Additionally, Asian American parents who valued more independence had children who exhibited more adaptive behaviors and fewer behavioral problems (Huang, Calzada, Cheng, Barajas-Gonzalez, & Brotman, 2017). In sum, acculturation plays an important role in immigrants' emotional well-being. However, it could either promote children's adjustment or lead to more problems.

Future Directions

Many of the existing studies on culture and emotions are based on measurements developed in Western cultures. In future cross-cultural research, measurement invariance, especially for surveys, should be checked and emphasized. Individuals in different cultures may hold different views of a phenomenon or behavior. For example, parents in different cultures have different perceptions of psychological symptoms. Johnson-Garwood (2016) asked Jamaican and American adults to read vignettes about an adolescent's internalizing and externalizing behaviors and rate the degree of seriousness of the problem, the degree a parent would worry, the degree a teacher would worry, unusualness, the likelihood of improvement, and the likelihood of referral. They found cultural differences in adults' thresholds for child problems. Jamaican adults reported less worry about boy's behavioral problems than did American adults. They also rated adolescents' behavioral problems as less unusual and more likely to improve than did American adults. Research has also shown that Americans tend to report more externalizing problems than people in many other Western cultures (Crijnen et al., 1997). Some behaviors, such as punishment, are considered more normative in some cultures than others (Lansford et al., 2005). The perception of normativeness of a behavior may influence the report of the behavior, which results in either underestimation or overestimation of cultural differences in the behavior. These methodological limitations make it difficult to interpret the cultural differences or the lack of cultural differences with the measurements developed only in Western cultures. Multiple methods and direct measurements, including observation and ethnographic approaches, will provide us with direct and diverse information and help us better understand cultural similarities and differences in emotion.

There has been relatively extensive research on parental socialization of children's negative emotions. However, positive emotions also play an important role in children's social emotional development. For example, when responding to children's positive emotions, African American mothers used complementary and contradictory responses, where they shared and expanded their children's positive emotions and also tried to diminish the positive emotions or teach lessons (McKee, Faro, O'Leary, Spratt, & Jones, 2015). However, there are only a few cross-cultural studies on socialization of children's positive emotions (Raval, Luebbe, & Sathiyaseelan, 2018; Song, Yang, Doan, & Wang, in press; also see the work by Tsai and colleagues on ideal affect, and work by Q. Wang and colleagues on mother-child conversations of positive versus negative experiences). In future research, more cross-cultural studies on parental socialization of children's positive emotions are called for. Additionally, emotion socialization from people other than parents, such as peers, may also play a critical role in children's emotional development, especially for older children and adolescents. Current research on emotion socialization has been focusing on parental socialization.

Studies on peer emotion socialization may help researchers further understand the transmission of cultural values as well as the interaction between host and home cultures in immigrant children's emotional development.

Culture is not static but ever-changing (Greenfield, 2018). Due to globalization and increasing intercultural exchanges, cultural values and practices may transform over time. It will be of great importance to investigate the influence of cultural changes on children's emotional development. For instance, X. Chen (2012) has studied how the dynamic cultural change in China influences the development of temperament in relation to psychosocial well-being. Emerging cultural dimensions and factors can also influence children's emotion and parental emotion socialization practices. In particular, social media has become a cultural force of our time, and it fundamentally shapes how emotion is expressed and communicated in the public space. It will be a fruitful area of research to study the effect of social media on emotional development. Finally, research on emotional development has primarily focused on Western children and cross-cultural studies have focused on Eastern-Western comparisons. Research of diverse communities is required in order to build a scientific knowledge base of emotional development.

References

Adachi, M., & Trehub, S. E. (2011). Canadian and Japanese preschoolers' creation of happy and sad songs. *Psychomusicology: Music, Mind and Brain., 21*, 69. https://doi.org/10.1037/h0094005

Adachi, M., Trehub, S. E., & Abe, J.-I. (2004). Perceiving emotion in children's songs across age and culture. *Japanese Psychological Research, 46*(4), 322–336. https://doi.org/10.1111/j.1468-5584.2004.00264.x

Ahadi, S. A., Rothbart, M. K., & Ye, R. (1993). Children's temperament in the US and China: Similarities and differences. *European Journal of Personality, 7*(5), 359–378. https://doi.org/10.1002/per.2410070506

Anderson, E. R., & Mayes, L. C. (2010). Race/ethnicity and internalizing disorders in youth: A review. *Clinical Psychology Review, 30*(3), 338–348. https://doi.org/10.1016/J.CPR.2009.12.008

Austin, A. A., & Chorpita, B. F. (2004). Temperament, anxiety, and depression: Comparisons across five ethnic groups of children. *Journal of Clinical Child & Adolescent Psychology, 33*(2), 216–226. https://doi.org/10.1207/s15374424jccp3302_2

Aznar, A., & Tenenbaum, H. R. (2013). Spanish parents' emotion talk and their children's understanding of emotion. *Frontiers in Psychology, 4*, 670. https://doi.org/10.3389/fpsyg.2013.00670

Bates, M. S., Edwards, W. T., & Anderson, K. O. (1993). Ethnocultural influences on variation in chronic pain perception. *Pain, 52*(1), 101–112. https://doi.org/10.1016/0304-3959(93)90120-E

Birman, D., & Taylor-Ritzler, T. (2007). Acculturation and psychological distress among adolescent immigrants from the former Soviet Union: Exploring the mediating effect of family relationships. *Cultural Diversity and Ethnic Minority Psychology, 13*(4), 337–346. https://doi.org/10.1037/1099-9809.13.4.337

Bowie, B. H., Carrère, S., Cooke, C., Valdivia, G., McAllister, B., & Doohan, E.-A. (2013). The role of culture in parents' socialization of children's emotional development. *Western Journal of Nursing Research, 35*(4), 514–533. https://doi.org/10.1177/0193945911411494

Bozicevic, L., De Pascalis, L., Schuitmaker, N., Tomlinson, M., Cooper, P. J., & Murray, L. (2016). Longitudinal association between child emotion regulation and aggression, and the role of parenting: A comparison of three cultures. *Psychopathology, 49*(4), 228–235. https://doi.org/10.1159/000447747

Brown, J. S., Meadows, S. O., & Elder, G. H. (2007). Race-ethnic inequality and psychological distress: Depressive symptoms from adolescence to young adulthood. *Developmental Psychology, 43*(6), 1295–1311. https://doi.org/10.1037/0012-1649.43.6.1295

Buck, R. (1984). *The communication of emotion*. New York: Guilford Press.

Camras, L. A., Kolmodin, K., & Chen, Y. (2008). Mothers' self-reported emotional expression in mainland Chinese, Chinese American and European American families. *International Journal of Behavioral Development, 32*(5), 459–463. https://doi.org/10.1177/0165025408093665

Camras, L. A., Oster, H., Campos, J., Campos, R., Ujiie, T., Miyake, K., … Meng, Z. (1998). Production of emotional facial expressions in European American, Japanese, and Chinese infants. *Developmental Psychology, 34*(4), 616–628. https://doi.org/10.1037/0012-1649.34.4.616

Cervantes, C. A. (2002). Explanatory emotion talk in Mexican immigrant and Mexican American families. *Hispanic Journal of Behavioral Sciences, 24*(2), 138–163. https://doi.org/10.1177/0739986302024002003

Céspedes, Y. M., & Huey, S. J. (2008). Depression in Latino adolescents: A cultural discrepancy perspective. *Cultural Diversity and Ethnic Minority Psychology, 14*(2), 168–172. https://doi.org/10.1037/1099-9809.14.2.168

Chan, S. M., Bowes, J., & Wyver, S. (2009). Parenting style as a context for emotion socialization. *Early Education and Development, 20*(4), 631–656. https://doi.org/10.1080/10409280802541973

Chaparro, M. P., Kim, H., Fernández, A., & Malti, T. (2013). The development of children's sympathy, moral emotion attributions, and moral reasoning in two cultures. *European Journal of Developmental Psychology, 10*(4), 495–509. https://doi.org/10.1080/17405629.2012.742008

Chen, D. (2009). *Culture, parent-child conversation, and children's understanding of emotions* (Unpublished doctoral dissertation). Harvard Graduate School of Education, Cambridge, MA.

Chen, S. H., Hua, M., Zhou, Q., Tao, A., Lee, E. H., Ly, J., & Main, A. (2014). Parent–child cultural orientations and child adjustment in Chinese American immigrant families. *Developmental Psychology, 50*(1), 189–201. https://doi.org/10.1037/a0032473

Chen, S. H., Zhou, Q., Eisenberg, N., Valiente, C., & Wang, Y. (2011). Parental expressivity and parenting styles in Chinese families: Prospective and unique relations to children's psychological adjustment. *Parenting, 11*(4), 288–307. https://doi.org/10.1080/15295192.2011.613725

Chen, S. H., Zhou, Q., Main, A., & Lee, E. H. (2015). Chinese American immigrant parents' emotional expression in the family: Relations with parents' cultural orientations and children's emotion-related regulation. *Cultural Diversity & Ethnic Minority Psychology, 21*(4), 619–629. https://doi.org/10.1037/cdp0000013

Chen, X. (2012). Human development in the context of social change: Introduction. *Child Development Perspectives, 6*(4), 321–325. https://doi.org/10.1111/j.1750-8606.2012.00259.x

Chen, X., DeSouza, A. T., Chen, H., & Wang, L. (2006). Reticent behavior and experiences in peer interactions in Chinese and Canadian children. *Developmental Psychology, 42*(4), 656–665. https://doi.org/10.1037/0012-1649.42.4.656

Choi, Y., Tan, K. P. H., Yasui, M., & Pekelnicky, D. D. (2014). Race–ethnicity and culture in the family and youth outcomes: Test of a path model with Korean American youth and parents. *Race and Social Problems, 6*(1), 69–84. https://doi.org/10.1007/s12552-014-9111-8

Cole, P. M., & Tan, P. Z. (2007). Emotion socialization from a cultural perspective. In *Handbook of socialization: Theory and research* (pp. 516–542).

Corapci, F., Friedlmeier, W., Benga, O., Strauss, C., Pitica, I., & Susa, G. (2017). Cultural socialization of toddlers in emotionally charged situations. *Social Development., 27*, 262. https://doi.org/10.1111/sode.12272

Crijnen, A. A., Achenbach, T. M., & Verhulst, F. C. (1997). Comparisons of problems reported by parents of children in 12 cultures: Total problems, externalizing, and internalizing. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*(9), 1269–1277. https://doi.org/10.1097/00004583-199709000-00020

Darwin, C. (1965). *The expression of the emotions in man and animals*. Chicago, IL: University of Chicago Press.

de l'Etoile, S. K. (2006). Infant-directed singing: A theory for clinical intervention. *Music Therapy Perspectives, 24*(1), 22–29. https://doi.org/10.1093/mtp/24.1.22

Denham, S, Bassett, H, Wyatt, (2007). T. The socialization of emotional competence. In J. Grusec, P. Hastings (Eds.), *Handbook of Socialization: Theory and Research* (pp. 614–637). New York, NY: Guilford Press.

Denham, S. A., Renwick-DeBardi, S., & Hewes, S. (1994). Emotional communication between mothers and preschoolers: Relations with emotional competence. *Merrill-Palmer Quarterly, 40*(4), 488–508. https://doi.org/10.2307/23087919

Denham, S. A., Zoller, D., & Couchoud, E. A. (1994). Socialization of preschoolers emotion understanding. *Developmental Psychology, 30*(6), 928–936. https://doi.org/10.1037/0012-1649.30.6.928

Doan, S. N., & Wang, Q. (2010). Maternal discussions of mental states and behaviors: Relations to emotion situation knowledge in European American and immigrant Chinese children. *Child Development, 81*(5), 1490–1503. https://doi.org/10.1111/j.1467-8624.2010.01487.x

Dunn, J., Brown, J., & Beardsall, L. (1991). Family talk about feeling states and children's later understanding of others' emotions. *Developmental Psychology, 27*(3), 448–455. https://doi.org/10.1037/0012-1649.27.3.448

Dunn, J., Slomkowski, C., Donelan, N., & Herrera, C. (1995). Conflict, understanding, and relationships: Developments and differences in the preschool years. *Early Education & Development, 6*(4), 303–316. https://doi.org/10.1207/s15566935eed0604_2

Eisenberg, N., Cumberland, A., & Spinrad, T. L. (1998). Parental socialization of emotion. *Psychological Inquiry, 9*(4), 241–273. https://doi.org/10.1207/s15327965pli0904_1

Eisenberg, N., Fabes, R. A., Shepard, S. A., Guthrie, I. K., Murphy, B. C., & Reiser, M. (1999). Parental reactions to children's negative emotions: Longitudinal relations to quality of children's social functioning. *Child Development, 70*(2), 513–534. https://doi.org/10.1111/1467-8624.00037

Eisenberg, N., Liew, J., & Pidada, S. U. (2001). The relations of parental emotional expressivity with quality of Indonesian children's social functioning. *Emotion, 1*(2), 116–136.

Ekman, P. (1972). Universal and cultural differences in facial expression of emotion. In *Nebraska symposium on motivation* (Vol. 19, pp. 207–284). Lincoln, Nebraska: University of Nebraska Press.

Ekman, P., & Friesen, W. V. (1971). Constants across cultures in the face and emotion. *Journal of Personality and Social Psychology, 17*(2), 124–129. https://doi.org/10.1037/h0030377

Ekman, P., Sorenson, E. R., & Friesen, W. V. (1969). Pan-cultural elements in facial displays of emotion. *Science (New York, N.Y.), 164*(3875), 86–88. https://doi.org/10.1126/SCIENCE.164.3875.86

Elfenbein, H. A., & Ambady, N. (2002). On the universality and cultural specificity of emotion recognition: A

meta-analysis. *Psychological Bulletin, 128*(2), 203–235. https://doi.org/10.1037/0033-2909.128.2.203

Essau, C. A., Ishikawa, S., Sasagawa, S., Sato, H., Okajima, I., Otsui, K., … Michie, F. (2011). Anxiety symptoms among adolescents in Japan and England: Their relationship with self-construals and social support. *Depression and Anxiety, 28*(6), 509–518. https://doi.org/10.1002/da.20819

Fabes, R. A., Eisenberg, N., & Eisenbud, L. (1993). Behavioral and physiological correlates of children's reactions to others in distress. *Developmental Psychology, 29*(4), 655. https://doi.org/10.1037/0012-1649.29.4.655

Fabes, R. A., Leonard, S. A., Kupanoff, K., & Martin, C. L. (2001). Parental coping with children's negative emotions: Relations with children's emotional and social responding. *Child Development, 72*(3), 907–920. https://doi.org/10.1111/1467-8624.00323

Fabes, R. A., Poulin, R. E., Eisenberg, N., & Madden-Derdich, D. A. (2002). The coping with Children's negative emotions scale (CCNES): Psychometric properties and relations with children's emotional competence. *Marriage & Family Review., 34*, 285. https://doi.org/10.1300/J002v34n03_05

Fishman, J. L., Raval, V. V., Daga, S. S., & Raj, S. P. (2014). Meta-emotion philosophy among Asian Indian immigrant mothers in the United States. *Qualitative Health Research, 24*(7), 875–889. https://doi.org/10.1177/1049732314537403

Fivush, R., & Wang, Q. (2005). Emotion talk in mother-child conversations of the shared past: The effects of culture, gender, and event valence. *Journal of Cognition and Development, 6*(4), 489–506. https://doi.org/10.1207/s15327647jcd0604_3

Friedlmeier, W., & Trommsdorff, G. (1999). Emotion regulation in early childhood: A cross-cultural comparison between German and Japanese toddlers. *Journal of Cross-Cultural Psychology, 30*(6), 684–711. https://doi.org/10.1177/0022022199030006002

Furukawa, E. (2005). *Cross-cultural differences in self-conscious emotions. Dissertation Abstracts International: Section B. Sciences and Engineering, 65*(9), 4869.

Gaias, L. M., Räikkönen, K., Komsi, N., Gartstein, M. A., Fisher, P. A., & Putnam, S. P. (2012). Cross-cultural temperamental differences in infants, children, and adults in the United States of America and Finland. *Scandinavian Journal of Psychology, 53*(2), 119–128. https://doi.org/10.1111/j.1467-9450.2012.00937.x

Garner, P. W., Jones, D. C., Gaddy, G., & Rennie, K. M. (1997). Low-income mothers' conversations about emotions and their children's emotional competence. *Social Development, 6*(1), 37–52. https://doi.org/10.1111/j.1467-9507.1997.tb00093.x

Garrett-Peters, P., Mills-Koonce, R., Zerwas, S., Cox, M., & Vernon-Feagans, L. (2011). Fathers' early emotion talk: Associations with income, ethnicity, and family factors. *Journal of Marriage and Family, 73*(2), 335–353. https://doi.org/10.1111/j.1741-3737.2010.00810.x

Gartstein, M. A., Gonzalez, C., Carranza, J. A., Ahadi, S. A., Ye, R., Rothbart, M. K., & Yang, S. W. (2006). Studying cross-cultural differences in the development of infant temperament: People's republic of China, the United States of America, and Spain. *Child Psychiatry and Human Development, 37*(2), 145–161. https://doi.org/10.1007/s10578-006-0025-6

Gartstein, M. A., Slobodskaya, H. R., Kirchhoff, C., & Putnam, S. P. (2013). Cross-cultural differences in the development of behavior problems: Contributions of infant temperament in Russia and U.S. *International Journal of Developmental Science, 7*(2), 95–104. https://doi.org/10.3233/DEV-1312104

Gartstein, M. A., Slobodskaya, H. R., Żylicz, P. O., Gosztyła, D., & Nakagawa, A. (2010). International journal of psychology and psychological therapy. *International Journal of Psychology and Psychological Therapy, 10*(1), 55.

Gelernter, J., Kranzler, H., Coccaro, E. F., Siever, L. J., & New, A. S. (1998). Serotonin transporter protein gene polymorphism and personality measures in African American and European American subjects. *American Journal of Psychiatry, 155*(10), 1332–1338. https://doi.org/10.1176/ajp.155.10.1332

Gherasim, L. R., Brumariu, L. E., & Alim, C. L. (2017). Parenting style and children's life satisfaction and depressive symptoms: Preliminary findings from Romania, France, and Russia. *Journal of Happiness Studies, 18*(4), 1013–1028. https://doi.org/10.1007/s10902-016-9754-9

Goforth, A. N. (2011). *Acculturation and psychological adjustment among Arab American adolescents* (Unpublished doctoral dissertation). Michigan State University, East Lansing, MI.

Gosselin, P., & Larocque, C. (2000). Facial morphology and children's categorization of facial expressions of emotions: A comparison between Asian and Caucasian faces. *The Journal of Genetic Psychology, 161*(3), 346–358.

Gottman, J., Katz, L., & Hooven, C. (1997). *Meta-emotion: How families communicate emotionally*. Mahwah, NJ: Lawrence Erlbaum.

Grabell, A. S., Olson, S. L., Miller, A. L., Kessler, D. A., Felt, B., Kaciroti, N., … Tardif, T. (2015). The impact of culture on physiological processes of emotion regulation: A comparison of US and Chinese preschoolers. *Developmental Science, 18*(3), 420–435. https://doi.org/10.1111/desc.12227

Greenfield, P. M. (2018). Studying social change, culture, and human development: A theoretical framework and methodological guidelines. In Q. Wang (Ed.), *Toward a cultural developmental science [Special issue]. Developmental Review*. *50*, 16–30. https://doi.org/10.1016/j.dr.2018.05.003

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and Well-being. *Journal of Personality and Social Psychology, 85*(2), 348–362. https://doi.org/10.1037/0022-3514.85.2.348

Gross, J. J., & Levenson, R. W. (1993). Emotional suppression: Physiology, self-report, and expressive behavior. *Journal of Personality and Social Psychology, 64*(6), 970. https://doi.org/10.1037/0022-3514.64.6.970

Halberstadt, A. G., Cassidy, J., Stifter, C. A., Parke, R. D., & Fox, N. A. (1995). Self-expressiveness within the family context: Psychometric support for a new measure. *Psychological Assessment, 7*(1), 93–103. https://doi.org/10.1037/1040-3590.7.1.93

Halberstadt, A. G., Fox, N. A., & Jones, N. A. (1993). Do expressive mothers have expressive children? The role of socialization in children's affect expression. *Social Development, 2*(1), 48–65. https://doi.org/10.1111/j.1467-9507.1993.tb00004.x

Hall, E. T. (1976). *Beyond Culture*. Garden City, NY: Anchor books.

Heine, S. J. (2015). *Cultural psychology*. New York, NY: WW Norton & company.

Ho, D. Y. F. (1986). Chinese pattern of socialization: A critical review. In M. H. Bond (Ed.), *The psychology of the Chinese people* (pp. 1–37). Hong Kong, China: Oxford University Press.

Holder, M. D., Coleman, B., & Singh, K. (2012). Temperament and happiness in children in India. *Journal of Happiness Studies, 13*(2), 261–274. https://doi.org/10.1007/s10902-011-9262-x

Hsu, C., Soong, W., Stigler, J. W., Hong, C., & Liang, C. (1981). The temperamental characteristics of Chinese babies. *Child Development, 52*(4), 1337. https://doi.org/10.2307/1129528

Huang, K.-Y., Calzada, E., Cheng, S., Barajas-Gonzalez, R. G., & Brotman, L. M. (2017). Cultural adaptation, parenting and child mental health among English speaking Asian American immigrant families. *Child Psychiatry & Human Development, 48*(4), 572–583. https://doi.org/10.1007/s10578-016-0683-y

Ishii, K., Reyes, J. A., & Kitayama, S. (2003). Spontaneous attention to word content versus emotional tone: Differences among three cultures. *Psychological Science, 14*(1), 39–46. https://doi.org/10.1111/1467-9280.01416

Ishii, K., Rule, N. O., & Toriyama, R. (2017). Context sensitivity in Canadian and Japanese children's judgments of emotion. *Current Psychology, 36*(3), 577–584. https://doi.org/10.1007/s12144-016-9446-y

Jack, R. E., Caldara, R., & Schyns, P. G. (2012). Internal representations reveal cultural diversity in expectations of facial expressions of emotion. *Journal of Experimental Psychology: General, 141*(1), 19–25. https://doi.org/10.1037/a0023463

Johnson-Garwood, C. R. (2016). *Using the threshold model to investigate Jamaican and American adult perspectives on adolescent internalizing and externalizing problems* (Unpublished doctoral dissertation). Alliant International University, Alhambra, CA.

Jolley, R. P., Zhi, Z., & Thomas, G. V. (1998). The development of understanding moods metaphorically expressed in pictures. *Journal of Cross-Cultural Psychology, 29*(2), 358–376. https://doi.org/10.1177/0022022198292006

Kagan, J., Arcus, D., Snidman, N., Feng, W. Y., Hendler, J., & Greene, S. (1994). Reactivity in infants: A cross-national comparison. *Developmental Psychology, 30*(3), 342–345.

Kagan, J., Kearsley, R. B., & Zelazo, P. R. (1978). *Infancy: Its place in human development*. Cambridge, MA: Harvard University Press.

Karkhanis, D. G., & Winsler, A. (2016). Temperament, gender, and cultural differences in maternal emotion socialization of anxiety, somatization, and anger. *Psychological Studies, 61*(3), 137–158. https://doi.org/10.1007/s12646-016-0360-z

Kawabata, Y., Crick, N. R., & Hamaguchi, Y. (2010). The role of culture in relational aggression: Associations with social-psychological adjustment problems in Japanese and US school-aged children. *International Journal of Behavioral Development, 34*(4), 354–362. https://doi.org/10.1177/0165025409339151

Keller, H., Lohaus, A., Kuensemueller, P., Abels, M., Yovsi, R., Voelker, S., … Mohite, P. (2004). The bio-culture of parenting: Evidence from five cultural communities. *Parenting, 4*(1), 25–50. https://doi.org/10.1207/s15327922par0401_2

Keller, H., & Otto, H. (2009). The cultural socialization of emotion regulation during infancy. *Journal of Cross-Cultural Psychology, 40*(6), 996–1011. https://doi.org/10.1177/0022022109348576

Kim, S. Y., Gonzales, N. A., Stroh, K., & Wang, J. J.-L. (2006). Parent–child cultural marginalization and depressive symptoms in Asian American family members. *Journal of Community Psychology, 34*(2), 167–182. https://doi.org/10.1002/jcop.20089

Kim, W. T., & Kim, J. L. (2012). The effects of parental attitude toward young children's emotional expression on their emotional intelligence and playfulness. *Journal of Yeolin Education, 20*, 71–92.

Kitayama, S., & Ishii, K. (2002). Word and voice: Spontaneous attention to emotional utterances in two languages. *Cognition & Emotion, 16*(1), 29–59. https://doi.org/10.1080/0269993943000121

Kitayama, S., Markus, H. R., & Matsumoto, D. (1995). Culture, self, and emotion: A cultural perspective on 'self-conscious' emotions. In J. P. Tangney & K. W. Fischer (Eds.), *Self-conscious emotions: The psychology of shame, guilt, embarrassment, and pride* (pp. 439–464). New York, NY: Guilford Press.

Lansford, J. E., Chang, L., Dodge, K. A., Malone, P. S., Oburu, P., Palmérus, K., … Quinn, N. (2005). Physical discipline and children's adjustment: Cultural normativeness as a moderator. *Child Development, 76*(6), 1234–1246. https://doi.org/10.1111/j.1467-8624.2005.00847.x

Lau, A. S., Jernewall, N. M., Zane, N., & Myers, H. F. (2002). Correlates of suicidal behaviors among Asian American outpatient youths. *Cultural Diversity & Ethnic Minority Psychology, 8*(3), 199–213. https://doi.org/10.1037//1099-9809.8.3.199

Le, T. N., & Kato, T. (2006). The role of peer, parent, and culture in risky sexual behavior for Cambodian and Lao/mien adolescents. *The Journal of Adolescent Health : Official Publication of the Society for Adolescent Medicine, 38*(3), 288–296. https://doi.org/10.1016/j.jadohealth.2004.12.005

Le, T. N., & Stockdale, G. D. (2005). Individualism, collectivism, and delinquency in Asian American adolescents. *Journal of Clinical Child & Adolescent Psychology, 34*(4), 681–691. https://doi.org/10.1207/s15374424jccp3404_10

Lee, H. R., & Chung, O. B. (2002). Children's emotional intelligence: Relationships with parental attitudes. *Korean Journal of Child Studies, 23*, 17–35.

Lee, J. H., Eoh, Y., Jeong, A., & Park, S. H. (2017). Preschoolers' emotional understanding and psychosocial adjustment in Korea: The moderating effect of maternal attitude towards emotional expressiveness. *Journal of Child and Family Studies, 26*(7), 1854–1864. https://doi.org/10.1007/s10826-017-0703-y

Lewis, M., Ramsay, D. S., & Kawakami, K. (1993). Differences between Japanese infants and Caucasian American infants in behavioral and cortisol response to inoculation. *Child Development, 64*(6), 1722–1731. https://doi.org/10.1111/j.1467-8624.1993.tb04209.x

Liu, C. H., Yang, Y., Fang, S., Snidman, N., & Tronick, E. (2013). Maternal regulating behaviors through face-to-face play in first- and second-generation Chinese American and European American mothers of infants. *Research in Human Development, 10*(4), 289–307. https://doi.org/10.1080/15427609.2013.846042

Liu, F. F., & Goto, S. G. (2007). Self-construal, mental distress, and family relations: A mediated moderation analysis with Asian American adolescents. *Cultural Diversity & Ethnic Minority Psychology, 13*(2), 134–142. https://doi.org/10.1037/1099-9809.13.2.134

Louie, J. Y., Oh, B. J., & Lau, A. S. (2013). Cultural differences in the links between parental control and children's emotional expressivity. *Cultural Diversity and Ethnic Minority Psychology, 19*(4), 424–434. https://doi.org/10.1037/a0032820

Louie, J. Y., Wang, S., Fung, J., & Lau, A. (2015). Children's emotional expressivity and teacher perceptions of social competence. *International Journal of Behavioral Development, 39*(6), 497–507. https://doi.org/10.1177/0165025414548775

Lowe, J. R., Coulombe, P., Moss, N. C., Rieger, R. E., Aragón, C., MacLean, P. C., … Handal, A. J. (2016). Maternal touch and infant affect in the still face paradigm: A cross-cultural examination. *Infant Behavior and Development, 44*, 110–120. https://doi.org/10.1016/J.INFBEH.2016.06.009

Lugo-Candelas, C. I., Harvey, E. A., & Breaux, R. P. (2015). Emotion socialization practices in Latina and European-American mothers of preschoolers with behavior problems. *Journal of Family Studies, 21*(2), 144–162. https://doi.org/10.1080/13229400.2015.1020982

Markham, R., & Wang, L. (1996). Recognition of emotion by Chinese and Australian children. *Ournal of Cross-Cultural Psychology, 27*(5), 616–643. https://doi.org/10.1177/0022022196275008

Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review, 98*(2), 224–253. https://doi.org/10.1037/0033-295X.98.2.224

Masuda, T., Wang, H., Ishii, K., & Ito, K. (2012). Do surrounding figures' emotions affect the judgment of target figure's emotion? Comparing the patterns of attention between European-Canadians, Asian-Canadians, Asian international students, and Japanese using eye-trackers. *Frontiers in Integrative Neuroscience: The Impact of Emotion on Cognition*. https://doi.org/10.3389/fnint.2012.00072

Matsumoto, D. (1991). Cultural influences on facial expressions of emotion. *Southern Communication Journal, 56*(2), 128–137. https://doi.org/10.1080/10417949109372824

Matsumoto, D., & Kishimoto, H. (1983). Developmental characteristics in judgments of emotion from nonverbal vocal cues. *International Journal of Intercultural Relations, 7*(4), 415–424. https://doi.org/10.1016/0147-1767(83)90047-0

Matsumoto, D., & Willingham, B. (2006). The thrill of victory and the agony of defeat: Spontaneous expressions of medal winners of the 2004 Athens Olympic games. *Journal of Personality and Social Psychology, 91*(3), 568–581. https://doi.org/10.1037/0022-3514.91.3.568

Matsumoto, D., Yoo, S. H., & Fontaine, J. (2008). Mapping expressive differences around the world. *Journal of Cross-Cultural Psychology, 39*(1), 55–74. https://doi.org/10.1177/0022022107311854

Matsumoto, D., Yoo, S. H., Nakagawa, S., & Multinational Study of Cultural Display Rules. (2008). Culture, emotion regulation, and adjustment. *Journal of Personality and Social Psychology, 94*(6), 925–937. https://doi.org/10.1037/0022-3514.94.6.925

McCord, B. L., & Raval, V. V. (2016). Asian Indian immigrant and white American maternal emotion socialization and child socio-emotional functioning. *Journal of Child and Family Studies, 25*(2), 464–474. https://doi.org/10.1007/s10826-015-0227-2

McKee, L. G., Faro, A. L., O'Leary, J. L., Spratt, K. H., & Jones, D. J. (2015). Socializing positive emotion: A qualitative study of African American single mothers and their adolescent youth. *Family Relations, 64*(5), 635–650. https://doi.org/10.1111/fare.12160

Murakami, F., Shimomura, T., Kotani, K., Ikawa, S., Nanba, E., & Adachi, K. (1999). Anxiety traits associated with a polymorphism in the serotonin transporter gene regulatory region in the Japanese. *Journal of Human Genetics, 44*(1), 15–17. https://doi.org/10.1007/s100380050098

Nakata, T., & Trehub, S. E. (2004). Infants' responsiveness to maternal speech and singing. *Infant Behavior and Development, 27*(4), 455–464. https://doi.org/10.1016/J.INFBEH.2004.03.002

Nelson, J. A., Leerkes, E. M., Perry, N. B., O'Brien, M., Calkins, S. D., & Marcovitch, S. (2013). European-American and African-American mothers' emotion socialization practices relate differently to their children's academic and social-emotional competence. *Social Development, 22*(3), 485–498. https://doi.org/10.1111/j.1467-9507.2012.00673.x

Nisbett, R. E. (2003). *The geography of thought: How Asians and Westerners think differently...and why*. New York, NY: The Free Press.

Norasakkunkit, V., & Kalick, S. M. (2002). Culture, ethnicity, and emotional distress measures. *Journal of Cross-Cultural Psychology, 33*(1), 56–70. https://doi.org/10.1177/0022022102033001004

Novin, S., Rieffe, C., & Mo, T. J. H. (2010). The role of situational goals and audience on self-reported emotion experience and expression: Dutch and south Korean children compared. *Infant and Child Development, 19*(4), 406–421. https://doi.org/10.1002/icd.671

Oh, S., & Lewis, C. (2008). Korean preschoolers' advanced inhibitory control and its relation to other executive skills and mental state understanding. *Child Development, 79*(1), 80–99. https://doi.org/10.1111/j.1467-8624.2007.01112.x

Okazaki, S. (1997). Sources of ethnic differences between Asian American and white American college students on measures of depression and social anxiety. *Journal of Abnormal Psychology, 106*(1), 52–60.

Porter, C. L., Hart, C. H., Yang, C., Robinson, C. C., Olsen, S. F., Zeng, Q., … Jin, S. (2005). A comparative study of child temperament and parenting in Beijing, China and the western United States. *International Journal of Behavioral Development, 29*(6), 541–551. https://doi.org/10.1177/01650250500147402

Ramirez, V. (2012). *The effects of parental acculturation and parenting behaviors on the social-emotional functioning of young Hispanic children* (Unpublished doctoral dissertation). Rutgers University, New Brunswick, NJ.

Raval, V. V., & Martini, T. S. (2009). Maternal socialization of children's anger, sadness, and physical pain in two communities in Gujarat, India. *International Journal of Behavioral Development., 33*, 215. https://doi.org/10.1177/0165025408098022

Raval, V. V., Raval, P. H., Salvina, J. M., Wilson, S. L., & Writer, S. (2013). Mothers' socialization of children's emotion in India and the USA: A cross- and within-culture comparison. *Social Development, 22*(3), 467–484. https://doi.org/10.1111/j.1467-9507.2012.00666.x

Raval, V. V., Li, X., Deo, N., & Hu, J. (2017). Reports of maternal socialization goals, emotion socialization behaviors, and child functioning in China and India. *Journal of Family Psychology: JFP: Journal of the Division of Family Psychology of the American Psychological Association, 32*(Division 43), 81. https://doi.org/10.1037/fam0000336

Raval, V. V., Luebbe, A. M., & Sathiyaseelan, A. (2018). Parental socializatio of positive affect, adolescent positive affect regulation, and adolescent grils' depression in India. *Social Development*. Advance online publication. https://doi.org/10.1111/sode.12325

Rispoli, K. M. (2011). *Parent-child interaction in the formation of emotional and social competence: The impact of individual differences and cultural variability* (Unpublished doctoral dissertation). Duquesne University, Pittsburgh, PA.

Rogoff, B. (2003). *The cultural nature of human development*. Oxford, UK: Oxford University Press.

Rosenqvist, J., Lahti-Nuuttila, P., Urgesi, C., Holdnack, J., Kemp, S. L., & Laasonen, M. (2017). Neurocognitive functions in 3- to 15-year-old children: An international comparison. *Journal of the International Neuropsychological Society, 23*(4), 367–380. https://doi.org/10.1017/S1355617716001193

Rothbart, M. K., & Bates, J. E. (2006). Temperament. In N. Eisenberg (Ed.), *Handbook of child psychology: Social, emotional, and personality development* (Vol. 3, pp. 99–166). New York, NY: Wiley.

Rothbart, N. I. K., & Derryberry, D. (1981). Development of individual differences in temperament. In M. E. Lamb & A. L. Brown (Eds.), *Advances in developmental psychology* (Vol. I, pp. 37–86). Hillsdale, NJ: Erlbaum.

Rubin, K. H., Hemphill, S. A., Chen, X., Hastings, P., Sanson, A., Coco, A. L., … Cui, L. (2006). A cross-cultural study of behavioral inhibition in toddlers: East–west–north–south. *International Journal of Behavioral Development, 30*(3), 219–226. https://doi.org/10.1177/0165025406066723

Russell, J. A. (1994). Is there universal recognition of emotion from facial expression? A review of the cross-cultural studies. *Psychological Bulletin, 115*(1), 102–141. https://doi.org/10.1037/0033-2909.115.1.102

Sabbagh, M. A., Xu, F., Carlson, S. M., Moses, L. J., & Lee, K. (2006). The development of executive functioning and theory of mind. A comparison of Chinese and U.S. preschoolers. *Psychological Science, 17*(1), 74–81. https://doi.org/10.1111/j.1467-9280.2005.01667.x

Song, Q., Yang, Y., & Wang, Q. (2016). Maternal socialization of facial and vocal expression of emotions and children's emotion knowledge: A cross-cultural investigation. In *Poster session presented at 23rd international congress of the International Association for Cross-Cultural Psychology (IACCP)*. Nagoya, Japan.

Song, Q., Yang, Y., Doan, S., & Wang, Q. (in press). Savoring or dampening? Maternal reactions to children's positive emotions in cultural contexts. *Culture and Brain.*

Streit, C., Carlo, G., Ispa, J. M., & Palermo, F. (2017). Negative emotionality and discipline as long-term predictors of behavioral outcomes in African American and European American children. *Developmental Psychology, 53*(6), 1013–1026. https://doi.org/10.1037/dev0000306

Super, C., & Harkness, S. (2002). Culture structures the environment for development. *Human Development, 45*, 270–274. https://doi.org/10.1159/000064988

Suveg, C., Zeman, J., Flannery-Schroeder, E., & Cassano, M. (2005). Emotion socialization in families of children with an anxiety disorder. *Journal of Abnormal Child Psychology, 33*(2), 145–155. https://doi.org/10.1007/s10802-005-1823-1

Tan, T. X. (2016). Emotional and behavioral disorders in 1.5th generation, 2nd generation immigrant children, and foreign adoptees. *Journal of Immigrant and Minority Health, 18*(5), 957–965. https://doi.org/10.1007/s10903-016-0388-0

Tao, A., Zhou, Q., Lau, N., & Liu, H. (2013). Chinese American immigrant mothers' discussion of emotion with children. *Journal of Cross-Cultural Psychology, 44*(3), 478–501. https://doi.org/10.1177/0022022112453318

Tao, A., Zhou, Q., & Wang, Y. (2010). Parental reactions to children's negative emotions: Prospective relations to Chinese children's psychological adjustment. *Journal of Family Psychology, 24*(2), 135–144. https://doi.org/10.1037/a0018974

Taumoepeau, M. (2015). From talk to thought: Strength of ethnic identity and caregiver mental state talk predict social understanding in preschoolers. *Journal of Cross-Cultural Psychology, 46*(9), 1169–1190. https://doi.org/10.1177/0022022115604393

Teo, B. H., Raval, V. V., & Jansari, A. (2017). Emerging adults' reports of maternal emotion socialization and their adjustment across cultures. *Journal of Applied Developmental Psychology, 52*, 59–68. https://doi.org/10.1016/J.APPDEV.2017.06.009

Trommsdorff, G., & Friedlmeier, W. (2010). Preschool girls' distress and mothers' sensitivity in Japan and Germany. *European Journal of Developmental Psychology, 7*(3), 350–370. https://doi.org/10.1080/17405620802252742

Tsai, J. L. (2007). Ideal affect: Cultural causes and behavioral consequences. *Perspectives on Psychological Science, 2*(3), 242–259. https://doi.org/10.1111/j.1745-6916.2007.00043.x

Tsai, S. J., Hong, C. J., & Cheng, C. Y. (2002). Serotonin transporter genetic polymorphisms and harm avoidance in the Chinese. *Psychiatric Genetics, 12*, 165–168.

Tsai, J. L., Louie, J. Y., Chen, E. E., & Uchida, Y. (2007). Learning what feelings to desire: Socialization of ideal affect through children's storybooks. *Personality and Social Psychology Bulletin, 33*(1), 17–30. https://doi.org/10.1177/0146167206292749

Valiente, C., Eisenberg, N., Fabes, R. A., Shepard, S. A., Cumberland, A., & Losoya, S. H. (2004). Prediction of children's empathy-related responding from their effortful control and parents' expressivity. *Developmental Psychology, 40*(6), 911–926. https://doi.org/10.1037/0012-1649.40.6.911

Wan, K. P., & Savina, E. (2016). Emotion regulation strategies in European American and Hong Kong Chinese middle school children. *Contemporary School Psychology, 20*(2), 152–159. https://doi.org/10.1007/s40688-015-0059-5

Wang, J. (2013). *Emotions and behaviors of Chinese and U.S. preschoolers in two emotionally challenging tasks* (Unpublished doctoral dissertation). Colorado State University, Fort Collins, Colorado.

Wang, Q. (2001). "Did you have fun?": American and Chinese mother–child conversations about shared emotional experiences. *Cognitive Development, 16*(2), 693–715. https://doi.org/10.1016/S0885-2014(01)00055-7

Wang, Q. (2003). Emotion situation knowledge in American and Chinese preschool children and adults. *Cognition and Emotion, 17*(5), 725–746. https://doi.org/10.1080/02699930302285

Wang, Q. (2004). The emergence of cultural self-constructs: Autobiographical memory and self-description in European American and Chinese children. *Developmental Psychology, 40*(1), 3–15. https://doi.org/10.1037/0012-1649.40.1.3

Wang, Q. (2006). Developing emotion knowledge in cultural contexts. *International Society for the Study of Behavioral Development Newsletter, 1*(49), 8–12.

Wang, Q. (2008). Emotion knowledge and autobiographical memory across the preschool years: A cross-cultural longitudinal investigation. *Cognition, 108*(1), 117–135. https://doi.org/10.1016/j.cognition.2008.02.002

Wang, Q. (2013a). Chinese socialization and emotion talk between mothers and children in native and immigrant Chinese families. *Asian American Journal of Psychology, 4*(3), 185–192. https://doi.org/10.1037/a0030868

Wang, Q. (2013b). *The autobiographical self in time and culture*. New York, NY: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199737833.001.0001

Wang, Q., & Brockmeier, J. (2002). Autobiographical remembering as cultural practice: Understanding the interplay between memory, self and culture. *Culture & Psychology, 8*, 45–64. https://doi.org/10.1177/1354067X02008001618

Wang, Q., & Fivush, R. (2005). Mother–child conversations of emotionally salient events: Exploring the functions of emotional reminiscing in European-American and Chinese families. *Social Development, 14*(3), 473–495. https://doi.org/10.1111/j.1467-9507.2005.00312.x

Wang, Q., Hutt, R., Kulkofsky, S., McDermott, M., & Wei, R. (2006). Emotion situation knowledge and autobiographical memory in Chinese, immigrant Chinese, and European American 3-year-olds. *Journal of Cognition and Development, 7*(1), 95–118. https://doi.org/10.1207/s15327647jcd0701_5

Wang, Q., & Leichtman, M. D. (2000). Same beginnings, different stories: A comparison of American and Chinese children's narratives. *Child Development, 71*(5), 1329–1346. https://doi.org/10.1111/1467-8624.00231

Watanabe, N. (2015). *Parental socialization of emotion in Japan: Contribution to preschoolers' emotion knowledge* (Unpublished doctoral dissertation). George Mason University, Fairfax, VA.

Wege, B. V., Gonzalez, M. L. S., Friedlmeier, W., Mihalca, L. M., Goodrich, E., & Corapci, F. (2014). Emotion displays in media: A comparison between American, Romanian, and Turkish children's storybooks. *Frontiers in Psychology, 5*, 600. https://doi.org/10.3389/fpsyg.2014.00600

Weis, M., Trommsdorff, G., & Muñoz, L. (2016). Children's self-regulation and school achievement in cultural contexts: The role of maternal restrictive control. *Frontiers in Psychology, 7*, 722. https://doi.org/10.3389/fpsyg.2016.00722

Weisz, J. R., Suwanlert, S., Chaiyasit, W., Weiss, B., Achenbach, T. M., & Walter, B. R. (1987). Epidemiology of behavioral and emotional problems among Thai and American children: Parent reports for ages 6 to 11. *Journal of the American Academy of Child & Adolescent Psychiatry, 26*(6), 890–897. https://doi.org/10.1097/00004583-198726060-00014

Wiesner, M., Arbona, C., Capaldi, D. M., Kim, H. K., & Kaplan, C. D. (2015). Mother-youth acculturation gaps and health-risking/emotional problems among Latin-American adolescents. *The Spanish Journal of Psychology, 18*, E52. https://doi.org/10.1017/sjp.2015.52

Williams, J. K. Y., Goebert, D., Hishinuma, E., Miyamoto, R., Anzai, N., Izutsu, S., … Baker, F. M. (2002). A conceptual model of cultural predictors of anxiety among Japanese American and part-Japanese American adolescents. *Cultural Diversity and Ethnic Minority Psychology, 8*(4), 320–333. https://doi.org/10.1037/1099-9809.8.4.321

Yang, Y., Koh, J. B. K., & Wang, Q. (2017). Discussion of internal states and behaviors in mother-child reminiscing: The longitudinal relations to children's emotion knowledge in European American and Chinese immigrant families. In A. Halberstadt & W. Friedlmeier (Eds.), *Socialization of emotion regulation: Goals and practices around the world. Paper symposium conducted at the biennial meeting of the Society for Research in child development (SRCD)*. Austin, TX.

Yang, Y., Song, Q., Doan, S., & Wang, Q. (in press). Maternal reactions to children's negative emotions: The relations to psychological adjustment, emotion knowledge, and coping in cultural contexts. *Transcultural Psychiatry.*

Yang, Y., & Wang, Q. (2016). The relation of emotion knowledge to coping in European American and Chinese immigrant children. *Journal of Child and Family Studies, 25*(2), 452–463. https://doi.org/10.1007/s10826-015-0224-5

Yang, Y., Wang, L., & Wang, Q. (2017). Take your word or tone for it? Children's understanding of emotional cues in speech in European American and Chinese Children. In *Poster session presented at the 39th annual meeting of the cognitive science society (CogSci)*. London, UK.

Yeh, K.-H., Bedford, O., Wu, C.-W., Wang, S.-Y., & Yen, N.-S. (2017). Suppression benefits boys in Taiwan: The relation between gender, emotional regulation strategy, and mental health. *Frontiers in Psychology, 8*, 135. https://doi.org/10.3389/fpsyg.2017.00135

Yuki, M., Maddux, W. W., & Masuda, T. (2007). Are the windows to the soul the same in the east and west? Cultural differences in using the eyes and mouth as cues to recognize emotions in Japan and the United States. *Journal of Experimental Social Psychology, 43*(2), 303–311. https://doi.org/10.1016/J.JESP.2006.02.004

Zahn-Waxler, C., Friedman, R. J., Cole, P. M., Mizuta, I., & Hiruma, N. (1996). Japanese and United States preschool children's responses to conflict and distress. *Child Development, 67*(5), 2462–2477. https://doi.org/10.1111/j.1467-8624.1996.tb01868.x

Emergent Emotions in Adolescence

Sarah J. Coe-Odess, Rachel K. Narr, and Joseph P. Allen

Abstract

This chapter discusses the causes and effects of changing patterns of emotional experience and expression in adolescence. Previously labeled the age of "storm and stress," adolescence is often considered a period of emotional turmoil. Although this label appears to overstate the difficulties of most adolescents, adolescence is nonetheless a critical period for emotional development, with emotional reactivity becoming more frequent and more intense. Changes can be understood, in part, as a response to anatomical, neurological, physiological, and cognitive developments occurring during this period. Both gender-related and environmental factors also considerably impact emotion expression and regulation. Despite the predominate focus in popular media on negative emotions in adolescence, there is also evidence of increases in positive emotions and of opportunity for emotional growth and regulation. This chapter explores various factors that help shape the positive and negative changes in emotion regulation and expression during adolescence.

The period of adolescence—defined broadly as lasting from the onset of puberty until the transition into adult roles—ranges longer today than it has in the past, as puberty typically begins earlier than before, and individuals obtain jobs and form families later than previously (Steinberg, 2016). Adolescence is a time in which individuals undergo significant changes, including—but not limited to—biological, social, economic, and psychological developments. Between physiological changes, increased autonomy and peer pressure, and increased stressors at school and at home, adolescents often face situations that put them at risk for emotion dysregulation and dysfunction. They also experience increases in self-awareness and cognitive reasoning abilities that equip them for handling these situations better as adolescence progresses. The timing and fluidity of these transitions vary both within and between persons, and the trajectories of increasing maturity are not always linear or smooth. Even amidst the variety in adolescent experiences and transitions, there are three characteristics of adolescence that are pervasive, universal, and likely to impact emotional regulation and expression: the onset of puberty, advances in cognitive capacity, and newly emerging roles and responsibilities (Hill, 1983). To date, substantial research has focused on the negative outcomes associated with the adolescent transition. Below, we consider various changes that occur during adolescence and consider the positive and negative contributions of these changes to emotions in adolescence.

S. J. Coe-Odess (✉) · R. K. Narr · J. P. Allen
University of Virginia, Charlottesville, VA, USA
e-mail: sjc5ps@virginia.edu

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_23

Theories of Emotions in Adolescence

G. Stanley Hall's "storm and stress" hypothesis (Hall, 1904)—one of the earliest theories of the role of emotion in adolescence—suggested that decreased self-control and increased sensitivity in adolescence cause elevated conflict with parents, mood disruptions, and risky behavior. Hall's theory was founded on the idea that hormonal changes during puberty cause turmoil that is inevitable, due to its biological roots. In line with these ideas, Erik Erikson's psychosocial stages of development (Erikson, 1959) characterized adolescence as an age of turmoil and identity crisis, shaped by puberty, societal demands, and pressure for the future. The ultimate goal of adolescence, Erikson asserted, is to resolve this crisis by creating a coherent sense of self. Psychologists generally continued to agree with Hall and Erikson until Albert Bandura (1964) challenged the storm and stress perspective by asserting that although most adolescents face potential turmoil, they are able to navigate this transitional period without severe disturbance. Psychologists have continued to debate whether this period should be considered an age of universal and inevitable stress and incomparably high emotions or whether it should, instead, be viewed, more simply, as a period characterized by *some* intense, negative emotional states (Arnett, 1999), rather than as an *entirely* stormy period. More recent work theorizes that adolescence is an age of evolving emotions, which increases risk for psychopathology due to increased blunting, heightening, or failing to modulate positive emotion effectively (Gilbert, 2012), but is also a time for opportunity and growth (Steinberg, 2014). The literature on positive emotions in adolescents is scant and lacking in theoretical underpinnings, though.

Changes in Emotional Intensity

Although most adolescents may manage to avoid an all-encompassing "storm," there is evidence for increased emotional intensity during adolescence. Via the experience sampling method, in which adolescents are given an electronic pager and asked to report their immediate emotions during two-hour intervals throughout the day, it appears that adolescents typically report more fluctuations in emotional states and more extreme, intense emotional experiences—both positive and negative—than children or adults (Gilbert, 2012; Larson, Moneta, Richards, & Wilson, 2002; Larson & Richards, 1994; Silvers et al., 2012; Somerville, Jones, & Casey, 2010). Not only do their moods change more quickly than those of adults, but adolescents also appear to be more emotionally reactive to small daily events than children (Rosenblum & Lewis, 2003). This is typically attributed to improved ability to respond to subtle cues, examine complex events in their memory, and anticipate future events (Rosenblum & Lewis, 2003).

Adolescents report more conflict-related emotions (e.g., anger, worry, and hurt) than preadolescents (Sallquist et al., 2009). More negative and global cognitive appraisals, attributions, and evaluations of oneself and of others coincide with these increasingly prevalent negative emotions (Hoffman, Cole, Martin, Tram, & Seroczynski, 2000; Mezulis, Abramson, Hyde, & Hankin, 2004; Silvers et al., 2012). Adolescents also appear to be particularly vulnerable to experiencing shame (Reimer, 1996), perhaps partly due to bodily changes, the juxtaposition between seeking individuation and maintaining approval and love from attachment figures, and psychosexual development; these feelings may be particularly strong if these changes or new experiences are considered socially unacceptable or threatening to attachments (Rosenblum & Lewis, 2003).

Although substantial research has focused on adolescents' reports of gradually increasing levels of negative emotions with development (e.g., Gilbert, 2012; Henker, Whalen, Jamner, & Delfino, 2002), there has been criticism that research disproportionately focuses on adolescents' emotional problems, rather than normative development (Steinberg & Morris, 2001) and that insufficient research has looked at whether there are similar changes in adolescents' positive emotional experiences (Gilbert, 2012; Somerville et al., 2010). Work that has been done

on positive emotions during adolescence suggests that although adolescents may experience more *extreme* positive emotions than children and adults do, on average, children reporting feeling "very happy" more frequently than adolescents, and adult mood states are also typically more positive than those of adolescents (Rosenblum & Lewis, 2003). Adults also report feeling more in control of their emotions than adolescents (Rosenblum & Lewis, 2003). It is clear, regardless, that heightened emotional experiences are a hallmark of this period of life, and future work will be needed to clarify further the extent to which this extends beyond stereotypic negative emotions.

Changes in the experience of and perception of emotions in adolescence must be understood in the context of ongoing physical, cognitive, emotional, and social development—particularly in early and mid-adolescence (Seiffge-Krenke, 2000). Even relative to other developmental stages, adolescence involves a particularly large number of transitions, novel situations, and new stimuli (Seiffge-Krenke, 2000), along with developmental changes in several systems that influence emotion regulation (Silk, Steinberg, & Morris, 2003; Spear, 2000). The myriad developmental changes that occur during this period both help explain and contribute to apparent changes in emotion during adolescence.

Physiological/Anatomical Development and Emotion

Adolescence involves many bodily and physiological changes that may factor into changes in emotional experience. Changes to physiological systems—particularly the sympathetic and parasympathetic nervous systems and the hypothalamic–pituitary–adrenal axis—influence emotional experience and expression. Paired with hormonal changes, development in these systems may underlie adolescent emotional arousal and sensitivity (Ahmed, Bittencourt-Hewitt, & Sebastian, 2015; Gunnar, Wewerka, Frenn, Long, & Griggs, 2009; Silvers et al., 2012; Stroud et al., 2009).

Among the most obvious and consequential markers of adolescence is puberty. Dorn and Biro (2011) identified three fundamental components of puberty: rapid growth, particularly in height and weight; development of primary sex characteristics (e.g., gonads) and subsequent hormonal changes; and development of secondary sex characteristics (e.g., changes in genitals, breasts, and bodily hair). Uneven growth spurts during puberty often cause young adolescents to be out of proportion, which can lead to feelings of awkwardness and embarrassment (Steinberg, 2016). These noticeable bodily changes may also create an inherent distance between adolescents and their parents, as parents may view their offspring as older, more responsible, and more deserving of autonomy (Laursen & Collins, 2009; Zimmer-Gembeck, Ducat, & Collins, 2011).

The bodily changes that occur during pubertal maturation may also lead to new types of arousal and new targets of motivation (Dahl, 2001; Silk et al., 2003). During sexual maturation, for example, new drives, motivations, emotional intensity, and experiences arise, and unfamiliar feelings emerge. Pubertal maturation is more closely linked to changes in sensation-seeking and risk-taking than chronological age (Martin et al., 2002). Puberty is also associated with an increased propensity to *seek* experiences that provoke high-intensity feelings, likely due to a desire to experience risk, excitement, thrill, and intensity (Dahl, 2004; Steinberg et al., 2004). Although this increased desire for sensation-seeking can increase risk for reckless behavior, it often simply prompts an affinity for excitement and is managed in healthy ways (Dahl, 2004). This increased motivation is largely attributable to hormonal changes, which increase desire for rewarding and sensation-seeking behaviors (Forbes & Dahl, 2010).

For a while, there was a consensus that the changes in arousal and motivation that arise as a result of puberty precede effective emotion regulation, which creates a gap in emotional experience and ability to manage this increased emotion; this disjunction was likened to an unskilled driver's starting an engine (Nelson et al., 2002), meaning that adolescents may seek

opportunities for autonomy before they have the emotional skillset to manage such opportunities (Steinberg, 2005). This analogy is an example of a dual-systems theory, in which a fast, automatic, and non-conscious process and another slow, controlled, and conscious process factor into a cognitive task. Dual-systems theories, however, have been criticized by some, as much of the research on dual-systems theories is cross-sectional, and few studies on dual systems among adolescents relate these systems to real-world behaviors (Pfeifer & Allen, 2012). Thus, the exact relationship among arousal, motivation, and emotion regulation remains unclear.

The biological changes of puberty also appear crucial in shaping the *content* of adolescents' emotional responses. The physical changes of puberty usually occur by the mid-teenage years (Dahl, 2004) and may increase adolescents' self-consciousness and concern with peers' opinions (Burnett, Bird, Moll, Frith, & Blakemore, 2009; Parker, Rubin, Erath, Wojslawowicz, & Buskirk, 2006; Steinberg, 2016; Zeman, Cassano, Perry-Parrish, & Stegall, 2006). The negative impact of puberty on self-image appears to be strongest among White females (Siegel, Yancey, Aneshensel, & Schuler, 1999). Some researchers have argued that this increased self-consciousness may increase the frequency and intensity of social emotions, such as guilt, shame, embarrassment, and pride (Burnett et al., 2009; Parker et al., 2006; Zeman et al., 2006).

Because social emotions promote affiliation and signal status—which are important to adult experience—the increase in experiencing these during adolescence may help prepare youth for more adult-like relationships. Given the importance of affiliation and interpersonal relationships, this increase is likely to be developmentally beneficial. Perhaps as a result, however, adolescents may be more sensitive to peer rejection, evaluation, and influence than their child and adult counterparts (Ahmed et al., 2015). Other researchers, on the other hand, assert that self-conscious expressions develop in younger children—due to their developmental tasks of learning societal rules and meeting expectations for behavior—and that these expressions simply develop further during adolescence, due to the evolving rules and standards for adolescents (Garcia & Scherf, 2015). Although self-conscious expressions may exist in childhood, however, the content that evokes these emotions may become more salient and prevalent as bodily changes occur. Thus, it seems possible that whereas self-conscious expression may continue to develop during adolescence, it is actually socially complex expression (e.g., sexual interest, contempt) that emerges during pubertal development, presumably because of the formation of romantic relationships and intimate friendships (Motta-Mena & Scherf, 2017).

Additionally, hormonal changes—particularly increases in levels of reproductive hormones—are associated with growing sensitivity to social status (Dahl, Allen, Wilbrecht, & Suleiman, 2018; Josephs, Newman, Brown, & Beer, 2003) and social feedback (Steinberg, 2008). Hormonal changes appear to emerge mostly between the ages of 9 and 12 (Dahl, 2004). One reason that hormones may particularly affect adolescents is that adolescents have not been exposed to hormonal levels this high previously (Rosenblum & Lewis, 2003). As adolescents adapt to their increased levels of hormones, however, individuals' mood fluctuations may become less extreme (Diener, Sandvik, & Larsen, 1985). Although some research has failed to detect associations between reproductive hormone levels and moods among adolescents, it is likely that these studies are assessing individuals after the acclimation has occurred (Rosenblum & Lewis, 2003).

Hormones may not only impact mood variability among early adolescents but also may increase negative affect. Hormonal changes are associated with increases in responsiveness to stress, which may help explain why adolescence is linked to vulnerability for onset of mental disorder (Sontag, Graber, Brooks-Gunn, & Warren, 2008; Walker, Sabuwalla, & Huot, 2004). Changes in hormones during early adolescence may prompt increased irritability, impulsivity, aggression, and depression, although, as adolescents get older and hormone levels stabilize, these effects likely decrease (Buchanan, Eccles, & Becker, 1992; Steinberg, 2016). It should be

noted, however, that the impact of hormones on mood during adolescence appears to be socially moderated, as individuals who have positive parent–child relationships appear to be less affected by high levels of testosterone and other hormones (Booth, Johnson, Granger, Crouter, & McHale, 2003; Susman, 1997). Additionally, *when* adolescents undergo puberty, relative to their peers, may better predict psychosocial functioning than puberty, itself, such that early maturation for girls has negative effects, as does late maturation for boys (Alsaker, 1992). Thus, it appears that to the extent that "storm and stress" does characterize some adolescents' experience, this is not solely a result of a biological shift, but also strongly affected by environment and timing (Schneiders et al., 2006).

Additionally, adolescents display increased physiological responses to emotional stimuli, relative to children. This includes increased pupillary reactivity—an indicator of cognitive load and emotional intensity—when presented with positively- and negatively-valanced emotions words (Silk et al., 2009). Adolescents who have undergone puberty also display higher startle responses than those who have not when presented with unpleasant and aversive photos (Quevedo, Benning, Gunnar, & Dahl, 2009), and experience more elevated hypothalamic–pituitary–adrenal (HPA) stress reactivity when preparing for a speech task and after a social rejection paradigm than younger children (Gunnar et al., 2009; Stroud et al., 2009). Although these physiological reactions are associated with negative affect—which, in turn, is associated with increased vulnerability for developing psychopathology (Axelson et al., 2003; Larson, Raffaelli, Richards, Ham, & Jewell, 1990)—these reactions are normative at this age (Gilbert, 2012).

Adolescence is also marked by increases in levels of neurotransmitters in the brain; specifically, there are increases in dopamine—which plays a role in experiencing reward—and serotonin—which plays a role in mood. Changes in levels of these neurotransmitters are related to hormonal changes and appear to affect emotions, stress response, and sensation-seeking (Ernst et al., 2005). Changes in levels of hormones, neurotransmitters, and bodily development also prompt emerging sexual interests, which introduce increases in emotion and motivation, and greater activation of selected drive systems (Dahl, 2004). These changes are associated, partly, with increased risk for mental health problems (Paus, Keshavan, & Giedd, 2008), but these trends in mental health associations subside as adolescents get older (Steinberg, 2016). Regardless of the specific mechanisms, it is evident that puberty does not simply co-occur with changes in emotional experience during adolescence but, rather, is an active ingredient in shaping the increased emotional intensity, reactivity, arousal, and motivation that occur during this period (Crone & Dahl, 2012; Garcia & Scherf, 2015; Scherf, Behrmann, & Dahl, 2012).

Structural Neurobiological Changes and Adolescent Emotion

Adolescence is a critical period for brain maturation (Yurgelun-Todd, 2007), particularly in emotional and motivational brain regions that are responsible for inhibiting responses, calibrating risk and reward, and regulating emotions (Spear, 2000; Steinberg, 2005). Neuroimaging research indicates that changes in brain structure and function during adolescence help adolescents consolidate their emotional responses, explore various styles and methods of expressing their emotion (Yurgelun-Todd, 2007), and experience gradual improvements in their executive functioning; improvements in executive functioning include decision-making and planning and suppressing inappropriate actions (Rosso, Young, Femia, & Yurgelun-Todd, 2004).

During adolescence, individuals recruit fewer but more diffuse numbers of brain regions that are specifically implicated in elevated emotional reactivity (Gilbert, 2012). Adolescence is also characterized by particular plasticity in emotion-related brain circuits (Ahmed et al., 2015), meaning that the neural elements in these brain regions adjust according to developmental and experiential demands. Plasticity allows for adaptive mechanisms for socioemotional processing

during adolescence and early adulthood (Crone & Dahl, 2012), which is crucial for managing the changing social demands and increased independence that occurs during this period (Simmonds, Hallquist, Asato, & Luna, 2014).

The limbic system—which influences emotional experience, social processing, and the experience of reward and punishment—undergoes significant changes during adolescence, many of which appear to factor into changes in emotional experience. One result of development in brain regions linked to emotion and motivation during adolescence appears to be increased emotional reactivity (Ernst, Pine, & Hardin, 2006; Nelson, Leibenluft, McClure, & Pine, 2005)—both positive and negative (Gilbert, 2012). Not only are the frontal-limbic neurocircuitry and neurobiological stress systems more active during adolescence, but they are also reorganized at this time, which contributes to more effective emotional processing (Zeman, Klimes-Dougan, Cassano, & Adrian, 2007).

Several studies have found that the amygdala—a part of the limbic system that is associated with positive and negative emotion—shows higher activation when adolescents—compared to children or adults—are presented with emotionally-salient stimuli (Ernst et al., 2005; Guyer et al., 2008; Monk et al., 2003). This appears to be particularly true when emotional cues signal threat (Casey et al., 2010), and this heightened activation may factor into the increased emotional reactivity that occurs during adolescence (LeDoux, 2000; May et al., 2004; McClure, Laibson, Loewenstein, & Cohen, 2004). Other research, however, has not consistently found that the amygdala shows heightened responses during adolescence, suggesting that the mechanisms at play are complex and not limited to a single brain region (McRae et al., 2012; Pfeifer et al., 2011; Pitskel, Bolling, Kaiser, Crowley, & Pelphrey, 2011; Vasa et al., 2011).

The prefrontal cortex, another part of the limbic system, also develops significantly during adolescence, though this development occurs later than that of the amygdala. Increased functional activity in the prefrontal cortex improves emotional processing capacity (Yurgelun-Todd, 2007), goal-oriented behavior (Casey et al., 2010), self-evaluation, emotional modulation and self-regulation, discrimination of emotional cues (Steinberg, 2005; Yurgelun-Todd, 2007), weighing risks and rewards, and impulse control (Casey, Tottenham, Liston, & Durston, 2005). The prefrontal cortex also is responsible for coordinating emotion and cognition (Steinberg, 2005) and contributes to socioemotional functioning (Steinberg, 2008). Developing prefrontal functioning during adolescence appears to sharpen abilities to identify, express, and manage emotions (Rosso et al., 2004). Enhanced connectivity between the prefrontal cortex and other parts of the limbic system also improves individuals' ability to regulate emotions and align thoughts and feelings (Asato, Terwilliger, Woo, & Luna, 2010; Dahl, 2001; Nelson et al., 2005). Moreover, during adolescence, there tends to be an increased activation of the dorsolateral prefrontal cortex (Adleman et al., 2002; Durston et al., 2002; Luna et al., 2001; Tamm, Menon, & Reiss, 2002), which facilitates improved reappraisal of emotions.

Whereas the developing prefrontal cortex appears to benefit adolescents' emotional awareness and processing, other parts of the developing limbic system may contribute to adolescents' increased sensitivity to their peers' judgments of them (Dahl, 2001; Nelson et al., 2005). This may prompt increased worries about and feelings of exclusion. Results from a study that used a Cyberball paradigm to exclude adolescent participants from a ball-throwing task by other virtual players suggest that a part of the limbic system called the subgenual anterior cingulate cortex (subACC) is uniquely elevated in adolescents—compared to adults—when experiencing exclusion, but not inclusion (Masten et al., 2009). The unique connection between the subACC and emotional distress in adolescence is unclear, although subACC activity is associated with higher levels of depression (Chen et al., 2007; Keedwell et al., 2009). It is possible that adolescents show patterns of subACC activation that resemble clinical populations more than adults do because adolescents display more emotional reactivity than adults and are still undergoing

development of this region (Gogtay et al., 2004; Masten et al., 2009). In fact, some dual-systems theories attribute heightened limbic reactivity to the onset of Major Depressive Disorder (Savitz & Drevets, 2009); there is debate, however, whether negative affect among depressed samples can be attributed to limbic activity in the amygdala (Davey, Yücel, & Allen, 2008; Dichter, Felder, & Smoski, 2009; Yang et al., 2010).

Another brain region that is particularly associated with emotion during adolescence is the ventral striatum, which is affiliated with decision-making, risk, and reward. Increased activity in the ventral striatum plays a role in changes in the brain's socioemotional network (Ernst et al., 2005; Matthews, Simmons, Lane, & Paulus, 2004). The ventral striatum also appears to regulate activity in the subACC, as well as other brain regions involved in emotional distress. The same Cyberball study on peer exclusion in adolescence found that greater activity in the ventral striatum relates to lower emotional distress, a pattern that does not similarly exist among adults. Thus, it is possible that the ventral striatum helps regulate negative affect during adolescence (Masten et al., 2009).

The nucleus accumbens—a brain region in the ventral striatum associated with reward and reinforcement—demonstrates particularly increased reactivity in adolescence (LeDoux, 2000; May et al., 2004; McClure et al., 2004). This reactivity occurs when adolescents are presented with positively-valenced stimuli (Ernst et al., 2005; Forbes et al., 2010; Galvan et al., 2006) and may explain adolescents' heightened reward sensitivity (Gilbert, 2012; McClure et al., 2004). In an fMRI study in which adolescents were told that other adolescents were interested in interacting with them via social media, perceptions of high- versus low-interest peers' social evaluation induced activation in brain regions that are affiliated with social reward, motivation, and visceral emotional response, including the ventral striatum, hippocampus, hypothalamus, and insula; these results increased with age, particularly among female participants (Guyer, McClure-Tone, Shiffrin, Pine, & Nelson, 2009). In another event-related fMRI procedure that was paired with a monetary reward task, adolescents had stronger activation in the ventral striatum, whereas adults had stronger activation in the amygdala; this study suggested that the nucleus accumbens plays a larger role in signaling differences between positive and negative outcomes in adolescents than in adults, whereas the amygdala plays a larger role in signaling differences in adults than in adolescents (Ernst et al., 2005).

Similarly to research on the amygdala, however, some researchers have observed hypoactivity or no differences between adolescents' and adults' ventral striatum response to rewards (Bjork, Smith, Chen, & Hommer, 2010; Geier, Terwilliger, Teslovich, Velanova, & Luna, 2009; Van Leijenhorst et al., 2010). Further, some longitudinal research on the transition from childhood to adolescence has indicated that activation in the ventral striatum is not associated with reward-seeking and maladaptive behavior but, rather, with resistance to peer pressure and decreased risky behavior (Pfeifer et al., 2011). Other longitudinal research has found that changes in activity in the ventral striatum are nonlinear and depend more on individual differences than on age (Urošević, Collins, Muetzel, Lim, & Luciana, 2012). Thus, it seems, more research is necessary to understand the specific roles of the amygdala, the ventral striatum, and other brain regions in changes in emotions during adolescence.

A further complication is that brain regions typically do not mature at a constant pace during adolescence, and connections among brain regions are in constant flux (Casey et al., 2010; Mills, Goddings, Clasen, Giedd, & Blakemore, 2014; Shaw et al., 2008). Brain development in approach-motivated, risk-seeking, and reward-seeking regions—such as the ventral striatum—occurs earlier than development in regulatory regions, such as prefrontal areas (Ernst, Romeo, & Andersen, 2009). The early maturation of the amygdala and the nucleus accumbens, relative to other regions of the brain, may help explain the high-intensity positive emotions that individuals often experience during early adolescence (Gilbert, 2012). The prefrontal cortex, on the other hand, develops toward the end of adolescence, although this "cognitive control" system

and tool for self-regulation becomes increasingly more efficient throughout adolescence and into early adulthood (Steinberg, 2008; Yurgelun-Todd, 2007). The combination of increased sensitivity to rewards and relatively delayed development in behavioral control areas may lead to adolescents' seeking immediate (vs. long-term) gains. This has been posited as one explanation for heightened emotional reactivity during this period (Casey, Jones, & Hare, 2008). Other theories, however, have posited that the development of prefrontally-mediated capacities may increase vulnerability to depression (Ernst et al., 2009; Nelson et al., 2005). Clearly, our understanding of how developing brain regions uniquely impact both positive and negative emotions during adolescence remains a work in progress.

Cognitive Changes and Emotion

In conjunction with the aforementioned, ongoing biological changes, adolescents also experience improvements in their emotional reasoning abilities (Larson, Clore, & Wood, 1999). Among these improvements are the ability to differentiate one's own emotional responses from the objective experience or the responses of others and the ability to comprehend conflicting and complex emotions, such as annoyance, resentment, and bliss. The ability to understand simultaneous, conflicting emotions appears to develop around 12 years old (Harter & Buddin, 1987). This new skill appears to be especially beneficial in interpersonal domains (Rosenblum & Lewis, 2003), in which teens frequently encounter both positive and negative aspects. Because the maturation of these skills is an ongoing process, adolescents do not employ these skills consistently (Keating, 1990; Larson et al., 1999). As a result, adolescents may be prone to making attributions based on limited traits of other people, and misleading cues may espouse jealousy or anger (Larson et al., 1999). With time, though, they become better able to read emotional cues (Herba & Phillips, 2004).

During early-to-middle adolescence, teens also solidify their formal operational and abstract reasoning skills. This change may enhance their insight into their own emotions (Larson et al., 1999) and may help them understand that the same event can trigger different emotional responses in different people (Rosenblum & Lewis, 2003). This cognitive development may also help adolescents to uncouple emotional responses from acute, immediate events and to generalize narrow emotional experiences of individuals to the experiences of groups of people. This may propel individuals toward social action, as they become better able to experience others' pain. Abstract thinking also helps adolescents anticipate and respond to the emotional experiences of themselves and others. As adolescents gain a better understanding of the ways others' viewpoints and emotions may differ from their own, they become more able to take into account contexts and determinants of emotional display (Rosenblum & Lewis, 2003).

Increased comprehension of the emotion expressed by others often leads adolesents to gain a sense of empathy (Rosenblum & Lewis, 2003). Despite having the cognitive capacity, the self-awareness, and the ability to infer others' emotions, however, adolescents may lack the ability—relative to adults—to process the suffering and negative affect of others (Royzman & Kumar, 2001). Without the tolerance for processing others' pain (Eisenberg et al., 1994), adolescents may have difficulty forming an empathic connection and may, instead, experience their own negative arousal and emotional distress (Rosenblum & Lewis, 2003). Consequently, this may encourage individuals to avoid situations that elicit empathic reactions for the foreseeable future (Eisenberg, 2000).

Abstract thinking may also create new internal experiences with emotional implications, as abstract ideas, anticipated events, and recalled events may now prompt negative emotions (Rosenblum & Lewis, 2003). Adolescents begin to realize the ambiguity of "knowing" something and the subjectivity of meaning; this realization may lead to rigidity and discomfort with what

they do not know. Adolescents may feel they cannot trust what is "known," which may cause them to swing to extremes of either making choices based primarily on emotions or appearing emotionally indifferent (Chandler, 1987). Abstract idealism can also lead adolescents to form extreme, "constructed" relationships that are not realistic (Inhelder & Piaget, 1958; Larson et al., 1999). Thus, cognitive maturity may increase adolescents' sensitivity, broaden their topics of concern, and heighten their standards and expectations, all of which make them more vulnerable and prone to disappointment (Larson & Asmussen, 1991).

Additionally, during adolescence, individuals still are actively developing a sense of self, which may render them more vulnerable to emotions derived from perceived affirmations—or lack thereof—of their identities (Larson et al., 1999). As adolescents experience new relationships and environments, they associate specific emotions with specific events, and a system of these associations are formative in adolescents' identity (Haviland-Jones & Kahlbaugh, 2000). As their emotional experiences change, so do their identities (Haviland-Jones & Kahlbaugh, 2000; Rosenblum & Lewis, 2003). Without a coherent sense of self, adolescents may be more susceptible to "personal fables," in which they perceive their experiences to be unique and, consequently, may feel more alone (Steinberg, 2016). They also tend to have an "imaginary audience," in which they feel especially self-conscious and fear others are watching and judging them (Steinberg, 2016). This effect peaks during mid-adolescence and decreases by late adolescence (Burnett, Sebastian, Kadosh, & Blakemore, 2011; Nelson et al., 2005; Pfeifer & Blakemore, 2012). It has even been hypothesized that adolescents with more advanced reasoning capacities tend to experience fewer positive states and that these capacities may thus increase—rather than mitigate—the stress of everyday life (Larson & Asmussen, 1991).

Concurrently, advanced reasoning may also enable adolescents to view the world more holistically and realistically and allow them to account for the future, rather than just the present. As they gain a more realistic sense of their environment, adolescents also get better at distinguishing internal from external experience. These emerging abilities allow adolescents to engage in multidimensional thinking, which improves their understanding of interpersonal systems; this helps adolescents to organize their thoughts and weigh them against other information to balance ideal and real (Keating, 1990, 2011; Labouvie-Vief, 1980; Rosenblum & Lewis, 2003). Better understanding of interpersonal relationships may also intensify emotions, as adolescents perceive other individuals as having personalities, instead of as being simply random agents of action (Rosenblum & Lewis, 2003). By thinking abstractly and beyond what is measurable and tangible, adolescents learn to engage in metacognition, which allows them to conceptualize relatively, in addition to absolutely (Keating, 2011). These more advanced cognitive skills may help protect against the tendency to make misattributions and distortions that have negative emotional impact (Larson et al., 1999). Hence, it is likely that increased abstract reasoning gives rise to both more positive *and* more negative emotional experiences under different circumstances.

As expectations change for adolescents, they learn to use their developing cognitive skills to control how and when they express their emotions. This becomes increasingly important as adolescents experience mixed emotions and struggle to discern not only what they feel but also what is socially appropriate to express. Adolescents feel a growing *need* to follow norms that dictate social interactions and discourse and, thus, may feel a need to dissemble, such that their emotions are expressed in ways contrary to their underlying experience (Rosenblum & Lewis, 2003). For example, the need to modulate emotional displays may be particularly important in peer interactions, as adolescents may display a strong "front" in order to seem calm and in control (Rosenblum & Lewis, 2003; von Salisch, 1991). Such a response may elicit positive social feedback, which likely would reinforce maintaining emotional control in future difficult situations (Saarni, 1999). The *ability* to

control emotional expression, however, does not develop immediately. In a study that asked 1st, 3rd, 5th, and 10th graders to listen to stories designed to elicit prosocial or self-protective display rules, 10th graders indicated that they would have more ease controlling their words than their facial expressions. In fact, their reported ability to control emotional displays was equivalent to that of the 5th graders (Gnepp & Hess, 1986). Despite this, adolescents with high levels of emotional expressiveness—even with negative emotions such as fear and worry—tend to have better self-concepts, feel more socially accepted, and experience greater psychological well-being, potentially because emotional expression helps relieve distress and increases support received from others (Bronstein, Briones, Brooks, & Cowan, 1996).

Adolescence is also a time in which individuals not only learn better and more sophisticated emotion recognition and control, but also learn more about which emotions are elicited by certain situations, and about the complexity of emotional dynamics and the ways they may differ from person to person (Larson, 2011). With this increased understanding of the complexity of emotions, they learn to navigate emotional episodes, as well as to predict how emotions will interact and how complex emotions may impact perception and reasoning in future situations (Larson, 2011; Rosenblum & Lewis, 2003). Thus, as their inductive and deductive reasoning improves, they become better able to compare emotions across situations and between themselves and others (Kuhn, 2009; Larson, 2011). Overall, during adolescence, individuals become better able to differentiate between subjective emotional responses and objective eliciting situations, to differentiate one's own emotions from those of others, to comprehend that conflicting emotions can occur simultaneously, and to discriminate among complex emotions. They also engage in more abstract reasoning, which both helps them see the world more holistically and increases their susceptibility to disappointment or unrealistic expectations.

Changing Social Dynamics, Relationships, and Emotion

Steinberg (2016) identified autonomy, identity development, intimacy with peers, and achievement as four major components of psychosocial development that occur during adolescence. Some of the major drivers of changes in each of these areas are alterations in emotional experience that occur during this period. Adolescence is a period of heightened autonomy-seeking (Klimes-Dougan & Zeman, 2007; McElhaney, Allen, Stephenson, & Hare, 2009; Steinberg et al., 2004; Steinberg, 2005; Steinberg & Avenevoli, 2000). Adolescents simultaneously distance themselves from parents and become closer to peers, as they gradually both become more independent and prepare for adult relationships (Brown, 2004). One type of autonomy that adolescents seek is emotional autonomy, defined as emotional detachment from parents. Emotional autonomy begins during early adolescence and continues into early adulthood (McElhaney et al., 2009). As adolescents grow older, they do not turn exclusively—and, eventually, not even primarily—to their parents to help console or support them when they are upset. This role is, instead, taken up by first peers (particularly same-sex peers), and, later, by romantic partners (Hazan & Zeifman, 1994; Wilkinson, 2010).

Simultaneously, adolescents progressively tend to feel less emotionally attached to their parents. In a prospective longitudinal study of pre-adolescent and adolescent boys at a residential summer camp, researchers found that homesickness decreases in prevalence with age (Thurber, 1995). Another study that provided individuals with hypothetical vignettes and asked several questions, including one about displaying emotions, found that adolescents also tend to be less willing than children or adults to express negative emotions in front of their parents. This is likely part of the process of trying to individuate (Zeman & Shipman, 1997). In addition to emotional autonomy, adolescents seek behavioral autonomy, defined as making independent decisions. This pursuit appears to be

critical for emotional development, as adolescents who can assert independent opinions in a secure, loving family environment are more likely to have higher self-esteem and better-developed coping skills; adolescents who lack autonomy, on the other hand, are more susceptible to depression and problems with self-esteem (Aquilino & Supple, 2001; Bender et al., 2007; McElhaney et al., 2009). It is important to note, however, that emotional autonomy is not representative of a severing of family relationships but, rather, a transformation of them (Laursen & Collins, 2009).

Although the quest for autonomy inherently alters the nature of the adolescent's parent–child relationship, the effect of the family on adolescent emotions remains pervasive. Adolescents tend to experience more positive affect and less irritability when they spend time with their family than when they spend time alone (Schneiders et al., 2007). Parental receptivity to emotion expression, starting in childhood, appears to benefit adolescents' psychosocial adjustment, potentially because emotional expressiveness learned in the family environment during childhood may continue during adolescence (Bronstein et al., 1996). For example, adolescents who had supportive and expressive families during late childhood tend to be more comfortable reporting emotions not traditionally affiliated with their gender role (e.g., crying for males and anger for females) (Bronstein et al., 1996). During this age, parents also focus on emotional socialization in their offspring and expect their adolescents to handle more emotionally-laden situations on their own (Cassano, Perry-Parrish, & Zeman, 2007; O'Neal & Magai, 2005).

Additionally, adolescence is a time of increased expectations for self-management, personal responsibility, and social participation, as well as of balancing seeking new identity and independence while still receiving reassurance and validation from others (McElhaney et al., 2009; Steinberg, 2016). Although positive in some regards, these increased expectations can cause conflicted and unfamiliar emotions (e.g., ambivalence and doubt). Given these social changes, new levels of expression, frequency, and intensity of emotion are normative (Ahmed et al., 2015; Gilbert, 2012; Silk et al., 2003). Changes in adolescents' social environments also have a significant impact on their emotional states. These changes can include normative changes in school settings, social hierarchy, and romantic environment (Rosenblum & Lewis, 2003; Simmons, Burgeson, Carlton-Ford, & Blyth, 1987). Similarly, increased levels of stress and daily hassles, paired with greater emotional instability (Collins & Steinberg, 2006), may elicit increased negative affect—both in terms of intensity and frequency (Lanteigne, Flynn, Eastabrook, & Hollenstein, 2014; Lougheed & Hollenstein, 2012; McLaughlin, Hatzenbuehler, Mennin, & Nolen-Hoeksema, 2011; Sallquist et al., 2009). There also appears to be a cumulative emotional impact of stressors (Simmons et al., 1987). Thus, the changing social environment appears to be a large determinant of emotional changes in adolescence.

Although conflict clearly also affects children and adults, adolescents appear especially affected by it. Emotional sensitivity and reactivity are particularly impacted by experiences of conflict and subsequent conflict resolution, either directly or witnessed during adolescence. Although disagreements with others and some level of conflict are normative, severe, frequent, or poorly-resolved conflict may be damaging (Laursen & Collins, 1994). For example, witnessing family conflict appears to increase adolescents' sensitivity to anger and to undermine their emotional understanding (Repetti, Taylor, & Seeman, 2002).

As adolescents increasingly spend less time with parents and more time with peers, both the nature of the parent–child relationships and the role of friendships shift. Friendships move from a focus on reciprocal play and shared activities to a focus on sharing emotional content, secrets, honesty, and trust (Brown & Larson, 2009; Collins & Steinberg, 2006; Shulman, Connolly, & McIsaac, 2011). As a result, expectations for peer relationships also change. These changes in expectations for peer companions introduce heightened emotional consequences for experiences within friendships. Increased emotional attention and

intimacy within friendships may also allow adolescents to form deeper peer relationships, which may have both short- and long-term positive impacts on social anxiety and depression (Narr, Allen, Tan, & Loeb, 2017; Vernberg, Abwender, Ewell, & Beery, 1992).

Over time, adolescents also begin to report more positive affect during peer interactions than they do during family interactions (Henker et al., 2002; Schneiders et al., 2007). Positive experiences within best friendships seem to be especially related to positive emotional outcomes during adolescence, as adolescents who have good, close friendships report greater happiness, better psychological adjustment, and higher self-worth (Berndt, 2002; Bukowski, Newcomb, & Hartup, 1998; Demir, Şimşek, & Procsal, 2013).

The effects of increased intimacy in peer relationships are not solely positive, however. Co-rumination—in which two individuals excessively discuss personal problems by talking repeatedly about the same issue without generating solutions, encourage one another to discuss problems, forecast future problems, and concentrate on negative affect—emerges as a coping mechanism during adolescence (Rose, 2002). Although co-rumination often reflects—and leads to—feelings of closeness between friends, its focus on problems without solutions often exacerbates worries for both individuals (Rose, 2002).

Conflict with peers, too, impacts emotional experience, and peer victimization leads to negative emotions, such as anger and sadness (Mahady Wilton, Craig, & Pepler, 2000) and is linked to high levels of emotional reactivity and arousal (Herts, McLaughlin, & Hatzenbuehler, 2012). Within close friendships, higher levels of relational victimization and conflict lead to increased internalizing symptoms (La Greca & Harrison, 2005). Over time, continued conflict with friends also leads to poorer social skills and, consequently, increased likelihood of greater emotional turmoil (Laursen & Collins, 1994). When adolescents and adults are asked describe the last time they were upset with members of their social network, adolescents are more likely than adults to express higher intensity and duration of anger when describing these events (Birditt & Fingerman, 2003), and adolescents also report experiencing more anger than sadness when presented with hypothetical situations regarding conflict with a friend (Whitesell & Harter, 1996). Despite this negative affect, these experiences within a peer context help adolescents to practice regulating their emotions more competently, as they strive to avoid the relationship dissolution more likely to result from conflicts in friendships than conflicts in families (Laursen, 1993).

Increased independent contact with peers also introduces new circumstances—such as engagement in romantic relationships, sexual behavior, and exposure to substance use—in which adolescents need to manage their emotions (McLaughlin et al., 2011). Novel social challenges, including gaining social acceptance and attracting romantic partners, arise as adolescents spend more time with peers (Silk et al., 2003). With this increased time with peers, adolescents experience more peer influence and pressure to fit in with and impress them (Gilbert, 2012; Sallquist et al., 2009). They also experience an increasing perceptual sensitivity to socially-complex expressions, such as contempt and sexual interest, which may be a function of pubertal development (Motta-Mena & Scherf, 2017). Perhaps as a result, adolescents experience more social stress than other age groups (Westenberg, Drewes, Goedhart, Siebelink, & Treffers, 2004).

Not only does more time with peers increase the impact of what others think, but it also heightens adolescents' awareness of the ways in which expressing emotions potentially affects their relationships (Zeman et al., 2006). Adolescents become selective with *which* emotions they express to various individuals and are more likely to express emotion when they expect a supportive reaction (Zeman et al., 2006). Generally, adolescents report that their friends respond supportively when they express negative emotions, using strategies such as reward (e.g., comforting, empathizing, and assisting) and override (e.g., distracting from emotions), rather than antagonistic strategies such as neglect and victimization (Klimes-Dougan et al., 2014).

As early adolescent relationships diversify and become increasingly important, jealousy may become more prevalent. One study on adolescent jealousy posed hypothetical interpersonal situations to early and late adolescents and asked about the extent to which the situation would make the individual jealous. Results indicated that early adolescents experience more jealousy, as well as anxiety about loyalty and rejection, with their best friends than children and late adolescents, and that this is particularly true for girls (Parker, Low, Walker, & Gamm, 2005). One hypothesis for the increase in jealousy during early adolescence is that, as adolescents begin to engage in more other-sex relationships, they may feel more nervous and insecure, which may cause them to focus more on loyalty and trust in their close friendships (Sullivan, 1953). Adolescents also appear to be particularly sensitive to peer rejection; in studies involving Cyberball activities that excluded participants and social rejection interactions with confederates, researchers have found that rejected or excluded adolescents show greater brain activation and stronger neuroendocrine and cardiovascular responses and that these responses are greater than those of excluded children (Bolling et al., 2011; Stroud et al., 2009).

In addition to the impact of changes in parent–adolescent relationships and friendships, the emergence of romantic relationships also has a significant impact on adolescent emotions. New romantic experiences introduce opportunities to acquire new skills and experience new—or newly intense—emotions, including desire, and they force adolescents to find ways to regulate unfamiliar romantic thoughts. Romantic emotions are significantly influenced by puberty, as the neurobiological changes of puberty motivate individuals to form romantic attachments and use their newly acquired reproductive tools. Increased attention—sometimes unwanted and confusing—as a result of individuals' changing bodies may also cause negative emotions in adolescence (Larson et al., 1999). Some researchers have argued that many of the changes in emotional experience during adolescence stem from actual and fantasized romantic relationships (Larson & Asmussen, 1991; Larson & Richards, 1994). Emotions related to romantic involvement often include anxiety, anger, jealousy, and despair (Larson et al., 1999). Pubertal status also appears to relate to feelings of love, in addition to these more negative emotions (Richards & Larson, 1993).

The romantically-focused social milieu may also impact biological predispositions toward romantic feelings. In a study that used recorded conversations, interviews, and field notes to investigate the development of feelings of romantic norms among sixth- to eighth-grade girls, researchers found that early adolescent females have already acquired social norms about romantic feelings, as well as feeling and expression norms to handle their own romantic life. Specifically, the relative importance of romantic relationships and the importance of continually being in love appear to be particularly salient among girls at this age (Simon, Eder, & Evans, 1992). Social norms likely promote and magnify attributions of love and may increase experiences of frustration, disappointment, and hurt, as individuals' romantic expectations and experiences may not coincide (Larson et al., 1999).

Perhaps as a result of these norms, adolescents may experience distress surrounding pressure to be in love and stress concerning choosing the "right" partner and recovering from break-ups (Larson et al., 1999; Simon et al., 1992). Adolescents may also experience shame, anxiety, and humiliation if their romantic experiences do not align with perceived peer expectations and experiences, as adolescents are particularly sensitive to peer influence regarding romantic relationships (Larson et al., 1999; Savin-Williams & Berndt, 1990). When adolescents are asked to report the causes of their emotions, they likely attribute strong emotions to peer relationships—particularly romantic relationships—as the cause, as well as state them as the reason for mood swings (Csikszentmihalyi & Larson, 1984; Larson et al., 1999; Rosenblum & Lewis, 2003). This may be due to the generally ephemeral nature of adolescent romantic relationships (Feiring, 1996) and is in contrast to children, who mostly attribute family situations as the cause of their emotional reactions (Csikszentmihalyi &

Larson, 1984). The new relationships, social demands, and physical changes that occur during adolescence may also hamper confidence (Hay & Ashman, 2003).

Despite this, the introduction of romantic emotions also prompts positive emotions, as enacting cultural scripts for romance can be emotionally rewarding. On average, adolescents report positive feelings during opposite-sex interactions (Richards, Crowe, Larson, & Swarr, 1998). Thus, the emergence of romantic desires and involvement may also give rise to confusion, excitement, and competing feelings of fear and intrigue; the struggle to manage the balance between immediate desires and long-term consequences may evoke a flux of mixed emotions (Dahl, 2001). As a result, emotions may arise and resolve for different reasons than they did in childhood (Steinberg, 2008).

As these multitudinous changes in social environments occur, adolescents explore a variety of emotional responses and forms of emotional expression (Yurgelun-Todd, 2007). Coupled with neurocognitive processes, social pressures during early adolescence might lead to unstable cognitive control capacities, and this instability may impair emotional processing and emotion regulation development and may help explain greater observed emotional volatility (Casey et al., 2010; Steinberg, 2005). By mid-adolescence, however, individuals typically have improved cognitive control (Luna, Garver, Urban, Lazar, & Sweeney, 2004). This, again, suggests that characterizing adolescence, as a whole, as being a period of "storm and stress" is an overstatement, and although there is undoubtedly increased emotional experience in response to new social pressures and stressors, adolescents quickly adapt and begin to respond in more adult ways to manage their more extreme emotions.

Gender and Emotion in Adolescence

Although the aforementioned changes in experience of emotion, context of emotion, and activation from emotion are common to all adolescents, substantial research has focused on gender differences in both the experience of and expression of emotions during adolescence. Gender stereotypes regarding emotion become stronger in adolescence than they are in childhood, with females' being perceived to be overall more emotional (Fivush & Buckner, 2000) and to experience and express sadness more often, and males' being perceived to experience and express anger more often (Fabes & Martin, 1991). There is debate, however, about whether there are gender differences in the ways individuals process emotional expressions at any developmental stage, including adolescence (Herba & Phillips, 2004; McClure, 2000; Motta-Mena & Scherf, 2017). A meta-analysis on gender and emotion processing in children and adolescence suggested that it may not be gender that impacts emotion processing at this age, but rather, the methodology of studies; self-report studies may bias perceptions of female adolescents as more skilled in emotion processing more than observational methods (Eisenberg & Lennon, 1983).

Regardless of internal experience, adolescence definitively marks an age during which gender differences in how individuals *outwardly* express emotions become more pronounced (Fivush & Buckner, 2000); these gender differences appear to remain throughout adulthood. Gender differences in emotion socialization begin in early childhood and continue into—and beyond—adolescence. From a young age, parents are more attentive and responsive to boys and girls when they display stereotypically gender role-consistent emotional behaviors, such as boys' demonstrating anger or frustration and girls' demonstrating submissiveness or warmth (Chaplin, Cole, & Zahn-Waxler, 2005). Although girls in Western society are expected to be understanding, emotionally intuitive, and warm, male adolescents are more likely to be praised and admired for their physical capabilities and stoicism or lack of emotional expression and intimacy (Polce-Lynch, Myers, Kilmartin, Forssmann-Falck, & Kliewer, 1998).

The pressures to fit into the stereotypic and socially sanctioned "masculine" and "feminine" roles likely shape a great deal of adolescent emotional expression. For example, it is expected that

young men will be more instrumentally helpful, and, thus, male adolescents tend to express caring and intimacy through deeds and actions, instead of through words (Fivush & Buckner, 2000; Parker et al., 2006; Rubin, Bukowski, & Parker, 2006). Females, on the other hand, are socialized throughout childhood to be emotionally expressive and, thus, during adolescence, are more verbal about their caring for others, which they demonstrate through self-disclosure and validation (Perry-Parrish & Zeman, 2011). Accordingly, a study of normal adolescents found that females experience negative, self-directed emotions more frequently and intensely and for longer periods of time than males; this is particularly true for shame, guilt, sadness, shyness, and hostility, particularly in interpersonal contexts. Males, though, report experiencing more contempt during adolescence and attribute their negative emotion to activities and achievement. They also are more likely to deny having any emotions (Stapley & Haviland, 1989).

In addition to overall differences in amount and type of emotional expression, male and female adolescents differentially display both negative and positive emotion expression, with females' overall expressing emotions more openly, regardless of the type of emotion. A meta-analysis of emotional expression from infancy to adolescence found that females show more positive emotions (e.g., happiness) than males and that this difference becomes more pronounced during adolescence (Chaplin & Aldao, 2013). The same meta-analysis found that females also express more internalizing symptoms (e.g., sadness, anxiety, sympathy) than males, another difference that becomes more pronounced during adolescence. Male adolescents, in contrast, display less sadness than female adolescents and do not report feeling better after expressing their sadness to other people (Bender, Reinholdt-Dunne, Esbjørn, & Pons, 2012). Female adolescents also have more difficulty regulating their negative emotions (Hampel & Petermann, 2006) and use more maladaptive coping strategies (Neumann, van Lier, Gratz, & Koot, 2010). Although during the preschool and middle-childhood years males tend to express more externalizing emotions (e.g., anger), by adolescence, females tend to express more externalizing emotions.

Meta-analyses of "moral" emotions (i.e., guilt, shame, pride, and embarrassment), as well as studies that have established performance tests of emotional awareness, have found that female adolescents also display less emotional clarity and more emotional non-acceptance (developing secondary responses to negative emotions) and difficulty in goal-oriented behavior when distressed (Else-Quest, Higgins, Allison, & Morton, 2012; Hamilton & Jensvold, 1992), as well as more guilt, shame, and self-directed hostility than males (Barrett, Lane, Sechrest, & Schwartz, 2000). One reason that adolescent girls may be particularly at risk of feeling shame is that, in adolescence, there are increased expectations for girls to be solicitous and aware of others' perceptions of them (Reimer, 1996). Additionally, girls' developing bodies and the heightened pressure in society to fit specific—and, frequently, unachievable—physical ideals heighten the chance of body dissatisfaction, distress, and shame (Blyth, Simmons, & Zakin, 1985; Reimer, 1996; Rosenblum & Lewis, 1999). It is possible that difficulties with emotion regulation among females result from their higher engagement in emotional expression and verbalization (P. K. Bender et al., 2012), as well as more attention to and awareness of emotions (Hampel & Petermann, 2006; Klimes-Dougan et al., 2014).

Not only do adolescent females express their emotions differently from adolescent males, but they also have different expectations for how people will respond to their emotional expression. When females display emotion, they expect and seek emotional support (Klimes-Dougan et al., 2014); when males display emotion, in contrast, they expect teasing and ridicule (Bronstein et al., 1996). In contrast, however, in supportive families, males' crying is associated with greater adolescent adjustment, whereas females' crying is associated with less adolescent adjustment (Brody & Hall, 2010). Interpersonally, female adolescents prefer to disclose their feelings to their peers than to their parents, whereas male adolescents do not show any significant preference for recipient of emotional disclosure (Hay & Ashman, 2003). Additionally, parents tend to pay more attention to and support their male offspring's accomplishments and actions

(Bronstein et al., 1996) and pay more attention to and support female offspring's emotions (Hay & Ashman, 2003). Notably, however, gender differences in expression of internalizing and externalizing emotions are less pronounced with adolescents' parents than with other adults and their peers, respectively, suggesting that youth are more restricted in how they perform gender with nonfamilial adults and peers (Chaplin & Aldao, 2013).

Emotion Regulation

As adolescents experience new contexts for strong emotions and more opportunity for both emotional vulnerability and growth, there is an increased need to manage their own emotions, select their own regulation strategies (Morris, Silk, Steinberg, Myers, & Robinson, 2007), and employ more diverse ways to do so than they did when they were younger (Eschenbeck, Kohlmann, & Lohaus, 2007; Gullone, Hughes, King, & Tonge, 2010). Among the strategies they use are reappraisal, suppression, concealing, emotional engagement, and active problem-solving (Lougheed & Hollenstein, 2012). The development of these abilities is important, as broader knowledge of emotion regulation strategies improves adolescents' abilities to draw on various ones. Most frequently, adolescents who cope by engaging with stressors are better adjusted than those who do not (Silk et al., 2003). Experiencing chronic emotion dysregulation (either lacking adaptive strategies or failing to implement them), on the other hand, can lead to blunted, exacerbated, or incongruent (i.e., unaligned feelings and actions) responses that increase risk for maladaptive functioning, such as depression and anxiety disorders or poor decision-making (Gilbert, 2012).

Early adolescence appears to be a particularly important period for the development of emotion regulation abilities (Silvers et al., 2012), as it immediately precedes many of the increased stressors mentioned earlier. Perhaps because of the combination of increased stressors and new expectations to handle situations with less support from parents (Seiffge-Krenke, 2000), adolescents also engage in more maladaptive coping strategies—such as passive avoidance, rumination, resignation, and aggression (Hampel & Petermann, 2006)—and fewer adaptive, emotion-focused distractions—such as minimization and distraction (Donaldson, Prinstein, Danovsky, & Spirito, 2000; Hampel & Petermann, 2005)—than do late-elementary-aged children. This shift may reflect a lack of guidance from supportive figures who have the experience to provide adaptive strategies. Although it is healthy and normative to begin to rely on peer supports at this time period, doing so also may leave adolescents vulnerable to utilizing more of these non-helpful emotion regulation strategies in the meantime. Maladaptive coping strategies, more than stressors themselves, predict later emotional problems (Hampel & Petermann, 2006; Seiffge-Krenke, 2000).

Fortunately, whereas some of the strategies used to deal with negative emotions are unhelpful, as noted above, early adolescents also tend to show maturation in their deductive reasoning, expertise, and efficiency of and capacity for information processing (Steinberg, 2005), and most adolescents learn to cope competently over time (Seiffge-Krenke, 2000). During adolescence, emotion regulation increases in flexibility, which allows for a better ability to recognize and understand one's own feelings, as well as the feelings of others; an increased comprehension of the selectivity of one's perceptions and judgments; and improved insight on how one's own emotions relate to behavior (Zimmermann & Iwanski, 2014). Not only do adolescents use more emotion regulation strategies than children do, but adolescents also use fewer passive regulation strategies (e.g., avoidance–denial–escape, suppression, passive-dependence) and more proactive regulation strategies (e.g., emotional coping, reflection on emotions, seeking social support) than adults do. One potential explanation for this is that adults experience less anger than adolescents, and anger partially mediates the relationship between age and proactive emotion regulation (Blanchard-Fields & Coats, 2008).

Just as the ability to regulate emotions in specific ways increases during adolescence, the variety of coping strategies used does, too (Donaldson et al., 2000; Seiffge-Krenke, 2000). Although certain emotion regulation strategies are more beneficial than others, having a broad repertoire of strategies appears to be crucial; it may be problematic to rely exclusively on one strategy, regardless of the effectiveness of the strategy (Ahmed et al., 2015; Westphal, Seivert, & Bonanno, 2010). Adolescents who use fewer regulation strategies tend to have more internalizing problems, whereas adolescents who employ a range of regulation strategies, utilize emotional information to problem-solve, and respond to situational demands tend to have fewer internalizing problems (Lougheed & Hollenstein, 2012).

Reappraisal—reconsidering an emotional situation from a different perspective—emerges during late childhood and becomes a common strategy during adolescence (Gullone et al., 2010). Adolescents' use of reappraisal is associated with effectively managing distressing emotions and with overall psychological well-being (Lougheed & Hollenstein, 2012). When adolescents are not prompted to reappraise emotionally, they show less brain activation in brain regions associated with social cognition (e.g., medial prefrontal region, posterior cingulate, and temporal region) than children or young adults do. When, on the other hand, adolescents *do* reappraise, these brain regions are activated more than those of children and emerging adults. Thus, even as adolescents begin to reappraise, it is still not an automatic process (Ahmed et al., 2015). Although reappraisal strategies increase across adolescence (John & Gross, 2004), their level stabilizes during late adolescence (Silvers et al., 2012).

Although suppression remains among the emotion regulation strategies employed by adolescents, use of suppression—minimizing the experience and expression of emotions—decreases during adolescence (Gullone et al., 2010). Consistent use of emotional suppression is associated with low tolerance for distress and poor general psychological well-being (Gross & John, 2003). Fortunately, most adolescents begin to problem-solve and seek social support (Eschenbeck et al., 2007). By learning how and when to rely on other people and adjusting their emotional experiences according to the context of the situation (Hofmann & Kashdan, 2010), adolescents can more easily enter and exit emotional states and become better able to handle emotional demands (Lougheed & Hollenstein, 2012).

Concealing—a regulation strategy aimed to achieve a social goal by minimizing how and which emotions are expressed—also becomes more prevalent during adolescence, as individuals seek to minimize the expression and experience of emotions in order to achieve social goals, through choosing how and which emotions to express in a given situation (Lougheed & Hollenstein, 2012; Perry-Parrish & Zeman, 2011). Concealment differs from suppression, in that suppression involves minimizing emotional experience and expression, regardless of the situation, whereas concealment is more socially focused (Lougheed & Hollenstein, 2012). Adolescents quickly grow better able to navigate their emotions to achieve social goals by masking their emotional expressions (Rosenblum & Lewis, 2003); examples of this include nervous laughter, sarcastic remarks, and other ways to dissemble their feelings. As a result, they modulate the frequency, intensity, and impact of their emotional reactions through their appraisals, arousal, and expression (Silvers et al., 2012). Males tend to receive more social pressure to suppress and conceal their emotions than females do (Gullone et al., 2010; Perry-Parrish & Zeman, 2011).

Although suppression and concealment may have negative implications, they are not, as a whole, problematic for adolescents; rather, they become problematic when they are used more heavily than other strategies (Lougheed & Hollenstein, 2012). Even "maladaptive" strategies (e.g., suppression or concealment) may be beneficial for adolescents in certain circumstances, such as when the intention is to maintain social relations by not showing one's true emotions (Bonanno et al., 2007; Lougheed & Hollenstein, 2012). Individuals who become over-reliant on suppression, however, may struggle to form rapport and maintain relationships

(Butler et al., 2003; Westphal et al., 2010). Fortunately, during adolescence, the ability to make decisions based on motivation, emotion type, and socio-contextual factors improves (Zeman et al., 2006). In sum, it is crucial that adolescents not only acquire a range of emotion regulation strategies but also have the social and self-awareness to know when to apply each (Campos, Walle, Dahl, & Main, 2011; Westphal et al., 2010).

Emotion and Psychopathology in Adolescence

Half of all lifetime anxiety, mood, impulse control, and substance use disorders begin by the age of 14, and adolescence is a particularly critical time in the onset of affective disorders (Kessler et al., 2005). Major depression rates, for example, sharply increase during adolescence, and incompetence in emotion regulation has been posited as contributing to the 300% increase in death and disability during adolescence (Dahl, 2001). This heightened susceptibility may be largely due to gaps in adolescents' emotional, cognitive, and behavioral development (Steinberg, 2005). Additionally, as noted above, structural changes in adolescents' processing of fear, threat, and anxiety may increase their risk for depression, as anxiety often precedes depression (Dahl, 2001). Additionally, neurobehavioral systems that are linked to reward require more intense or frequent stimuli in adolescence to achieve reward activation, which may make positive situations less pleasurable to adolescents than to children and adults (Dahl, 2001; Galvan, 2010).

Difficulty regulating negative affect is a clear risk factor for internalizing clinical disorders such as depression and anxiety (Glied & Pine, 2002; Lougheed & Hollenstein, 2012; McLaughlin et al., 2011; Silvers et al., 2012) and externalizing disorders (Beauchaine, Gatzke-Kopp, & Mead, 2007) during adolescence. Overall, however, the effects of emotion dysregulation are more strongly implicated in the development of internalizing problems than of externalizing problems (Garnefski, Kraaij, & van Etten, 2005). The increase in depression is particularly great during puberty, perhaps because the increase in dopamine and reward-seeking may cause adolescents to become frustrated and depressed when they do not feel rewarded by intimate friendships and romantic relationships (Davey et al., 2008).

Emotional symptoms of depression include dejection, decreased enjoyment of pleasurable activities, and low self-esteem (Steinberg, 2016). One survey found that 30% of high school students feel sad and hopeless to the extent of stopping regular activities, and 16% of high schoolers seriously consider suicide (Eaton et al., 2012). There are estimates that up to 15% of individuals will experience at least one major depressive episode by the time they are 18 years old (Merikangas et al., 2010). Some reasons for the increased prevalence of depression in adolescence include the increased stressors during this period (Graber & Sontag, 2009) and the cognitive changes during adolescence that allow for introspection and rumination that are associated with depression (Avenevoli & Steinberg, 2001). Adolescents who use more maladaptive emotion regulation strategies—such as suppression, rumination, and emotional disengagement—rather than adaptive strategies—such as reappraisal, problem-solving, and distracting—display more depressive symptoms (Betts, Gullone, & Allen, 2009; Hilt, McLaughlin, & Nolen-Hoeksema, 2010; McLaughlin et al., 2011).

Following social baseline theory, which suggests that social interaction helps to regulate one's emotions and conserve energy and resources (Beckes & Coan, 2011), social support and interaction can play important roles in adolescent emotion regulation and internalizing symptoms. Adolescents who spend time with family experience less anxiety and fewer depressed moods than when they spend time alone (Schneiders et al., 2007), and, over time, positive peer interactions also come to predict less anxiety. Co-rumination among peers, however, may exacerbate depressive symptoms and anxiety (Rose, 2002). In contrast, adolescents who engage in more conflict

with their parents are more prone to develop internalizing disorders characterized by anxious and depressed affect (Noller & Callan, 2015).

Emotional experiences and emotion regulation ability during adolescence also are linked to future, as well as concurrent, psychological functioning. Adolescents who report lower levels of daily happiness display more depressive symptoms 1 year later, even in non-clinical samples (Lonigan, Phillips, & Hooe, 2003; Neumann, Van Lier, Frijns, Meeus, & Koot, 2011). Prior to a depressive episode, blunted affect is common among adolescents who are at risk for depression (Gilbert, 2012), and adolescents' emotion dysregulation predicts future trouble with anxiety, aggression, and eating pathology (McLaughlin et al., 2011). Rumination, particularly, is associated with both concurrent and future adolescent psychopathology (Abela, Brozina, & Haigh, 2002; Burwell & Shirk, 2007). Further, poor emotional awareness in adolescence is associated with low self-esteem, depression, anxiety (Fernandez-Berrocal, Alcaide, Extremera, & Pizarro, 2006), social anxiety (Rosso et al., 2004), and deviance in adolescence (Petrides, Frederickson, & Furnham, 2004). Close friendships, on the other hand, appear to protect against depression and anxiety and to predict increasing self-worth over time (Narr et al., 2017). As individuals leave adolescence and enter adulthood, however, they experience fewer stressors and may even experience declines in levels of depression (Brown, Meadows, & Elder Jr., 2007; Seiffge-Krenke, Aunola, & Nurmi, 2009).

Additionally, as emotional expression diverges for young men and women, gender differences in these disorders also emerge during adolescence (Dahl, 2001). Prior to adolescence, there are no gender differences in depression (Nolen-Hoeksema, 1994). A spike in female depression rates occurs during puberty, however, resulting in a female-to-male depression ratio of 2:1 by age 13–15 (Dahl, 2001; Nolen-Hoeksema, 1994). During early adolescence, females appear to experience more intrapersonal stress, which can lead to depression and other internalizing problems (Ge, Natsuaki, Neiderhiser, & Reiss, 2009); this increase in stress may be at least partly because bodily changes that occur during puberty tend to cause more stress for girls than for boys. Not only may girls experience more stress, but they may also internalize it more. Females cope more passively and ruminate more with respect to their negative emotions. Rumination, in turn, is linked with longer, more severe depressive episodes (Nolen-Hoeksema, 1994) and with anxiety (Rose, 2002) among adolescents. This, alone, cannot explain the increased female-to-male depression ratio in adolescence, though, because prepubescent females already ruminate more than male adolescents (Nolen-Hoeksema, 1994). Other theories involve the possibility that females are more susceptible to genetic influences on depression (Jacobson & Rowe, 1999), that changes in social roles during puberty predispose females to be more vulnerable to psychological distress (Wichstrøm, 1999), or that girls are socialized to focus on emotions, rather than to problem-solve (Perry-Parrish & Zeman, 2011).

Females' ruminative tendencies may interact with stressors that are especially prevalent among females (e.g., bodily dissatisfaction, gender stereotypes, and sexual harassment) during adolescence (Nolen-Hoeksema, 1994). The introduction of dating may also create new social stressors by increasing self-appraisals of physical attractiveness and social comparison of peers' dating trajectories (Collins, 2003). Gender differences in depressive symptoms appear to emerge around 11–12 years old (Ohannessian, Lerner, Lerner, & von Eye, 1999) and increase even further from early-to late adolescence (Nolen-Hoeksema, 1994). In contrast to females, males are less likely to ruminate, instead remaining activity-focused and avoiding discussions of problems (Buhrmester, 1998). This lower level of rumination may help protect them from some emotional problems. Female adolescents also experience more anxiety than male adolescents (Bender et al., 2012). Emotional precipitants of anxiety differ by gender: in girls, limited emotion regulation strategies and lack of emotional clarity predict anxiety, whereas in boys, nonacceptance of negative emotional responses predicts anxiety (Bender et al., 2012). Emotion

dysregulation is also more predictive of anxiety in female adolescents than it is in male adolescents (P. K. Bender et al., 2012).

Not only do gaps in adolescent emotion regulation predict the development of psychological symptoms, but adolescents who struggle with psychopathology also experience emotions differently. Depressed adolescents experience positive affect less frequently, and when they do experience it, the positive emotion lasts for a shorter period of time than it does for non-depressed adolescents (Forbes, Williamson, Ryan, & Dahl, 2004; Gilbert, 2012; Sheeber et al., 2009). Depressive symptoms in adolescence are associated with avoidance, rumination, and limited support-seeking, problem-solving, emotional disengagement, and cognitive restructuring (Gratz & Roemer, 2004; McLaughlin et al., 2011; Silk et al., 2003; Weinberg & Klonsky, 2009), suggesting that depressed adolescents tend to be passive copers. Thus, increased stress during adolescence coincides with increased vulnerability for psychopathology—particularly internalizing disorders—and increasingly intimate relationships can both exacerbate and mitigate this vulnerability, given the simultaneous benefits and consequences of co-rumination for adaptive coping.

Conclusion

Adolescents face an inherent challenge as they seek autonomy and claim responsibility for their emotions while simultaneously facing new social demands for which emotional guidance may be essential. In addition to new social relationships, social roles, and social understanding and expectations, adolescents experience biological, neurological, and physiological changes that prompt and exacerbate the frequency, longevity, and intensity of many emotions. Although these changes are developmentally normative, they occur at different ages and rates—both within and across individuals—potentially making this time of life feel unpredictable, confusing, and isolating, despite also being exciting and novel.

Although research has paid substantial attention to the ways that neurological or hormonal changes impact shifts in emotional intensity, duration, and expression during adolescence, the social environment appears to be an equally large—if not larger—determinant of adolescents' emotional experiences. Evidence for the impact of specific regions of the brain such as the amygdala and the nucleus accumbens on changes in emotion during adolescence is mixed, as is evidence of the specific roles of hormones and puberty. Nonetheless, the multitude of changes that occur during adolescence inevitably impacts the way individuals perceive and express emotions. It seems possible, then, that the task of incorporating new cognitive and physiological changes may, at least partly, cause changes in emotional experience (Rosenblum & Lewis, 2003).

Among the most crucial skills for adolescents to develop are regulating and modulating intense emotions; learning to self-soothe and attend to emotions; understanding emotional expression versus dissemblance for themselves and others; separating momentary emotional experiences from overall identity; distinguishing feelings from facts; maintaining interpersonal relationships that fuel strong emotions; managing empathic experiences; and using newly developed cognitive skills to understand the nature and source of emotions (Larson et al., 1999; Rosenblum & Lewis, 2003; Saarni, 1999). It seems that the acquisition of these skills—rather than the fleeting emotions that occur during adolescence—is the most enduring consequence of adolescent emotional experience (Rosenblum & Lewis, 2003).

Most adolescents navigate the challenges of learning appropriate regulation and expression of emotions successfully, but some have difficulties that perpetuate throughout this critical period and, sometimes, beyond. Both the ability to use effective emotion regulation strategies, such as cognitive reappraisal and active engagement, and the flexibility to employ different strategies, depending on the context of the situation, appear crucial to positive emotional well-being. Primary

usage of maladaptive regulation strategies, such as suppression, in contrast, appears to contribute to negative emotional outcomes. Fortunately, it is the frequency of using these strategies and limited breadth of regulation strategies that appear to matter more than the use of any individual strategy. Adolescents generally increase in their sophistication and frequency of usage of positive emotion regulation strategies over the course of adolescence.

Difficulties with emotion regulation appear to put adolescents at greater risk for internalizing and affective disorders. This includes both internalizing disorders such as depression and anxiety and externalizing disorders such as conduct disorder and aggression. Adolescents who struggle with these issues often perceive and process emotions differently than healthy adolescents, and difficulties in emotion processing appear to contribute to an increasing rate of suicide attempts across adolescence. Despite these increased vulnerabilities, most adolescents manage to develop an adaptive, healthy emotion regulation system.

Although there has been a long-standing debate about whether adolescence should be characterized as primarily a period of "storm and stress" (Hall, 1904; Steinberg, 2002), it is indisputable that adolescence is an age of rapid fluctuations in mood, which often feel intense to the adolescent and appear as such to observers. This overall characterization, however, masks substantial variation across individuals in emotional experience—variation that largely reflects individual differences in developing capacities to recognize and regulate emotions effectively. Instead, it may be beneficial to view adolescence as a time in which the emotional landscape is unmatched by that of childhood or adulthood (Rosenblum & Lewis, 2003). By emerging adulthood—defined as ages 18–25 (Arnett, 2004)—most individuals appear to be significantly more carefree, optimistic, and independent, and mental health often improves (Arias & Hernández, 2007; Arnett, 2007; Gottlieb, Still, & Newby-Clark, 2007). Thus, the negative effects of emotion experienced in adolescence do not typically appear to be disruptive in the longer term. Rather, adolescence appears to be a period of both emotional vulnerability and potential for growth, as individuals acclimate to new environments, discover new relationships and forms of expression, and grasp a better understanding of the interplay among their emotions, behaviors, and interactions.

References

Abela, J. R. Z., Brozina, K., & Haigh, E. P. (2002). An examination of the response styles theory of depression in third-and seventh-grade children: A short-term longitudinal study. *Journal of Abnormal Child Psychology, 30*(5), 515–527. https://doi.org/10.1023/A:1019873015594

Adleman, N. E., Menon, V., Blasey, C. M., White, C. D., Warsofsky, I. S., Glover, G. H., & Reiss, A. L. (2002). A developmental fMRI study of the Stroop color-word task. *NeuroImage, 16*(1), 61–75. https://doi.org/10.1006/nimg.2001.1046

Ahmed, S. P., Bittencourt-Hewitt, A., & Sebastian, C. L. (2015). Neurocognitive bases of emotion regulation development in adolescence. *Developmental Cognitive Neuroscience, 15*, 11–25. https://doi.org/10.1016/j.dcn.2015.07.006

Alsaker, F. D. (1992). Pubertal timing, overweight, and psychological adjustment. *The Journal of Early Adolescence, 12*(4), 396–419. https://doi.org/10.1177/0272431692012004004

Aquilino, W. S., & Supple, A. J. (2001). Long-term effects of parenting practices during adolescence on well-being outcomes in young adulthood. *Journal of Family Issues, 22*(3), 289–308. https://doi.org/10.1177/019251301022003002

Arias, D. F., & Hernández, A. M. (2007). Emerging adulthood in Mexican and Spanish youth: Theories and realities. *Journal of Adolescent Research, 22*(5), 476–503. https://doi.org/10.1177/0743558407305774

Arnett, J. J. (1999). Adolescent storm and stress, reconsidered. *American Psychologist, 54*(5), 317–326. https://doi.org/10.1037//0003-066X.54.5.317

Arnett, J. J. (2004). *Emeging adulthood: The winding road from the late teens through the twenties*. New York, NY: Oxford University Press. https://doi.org/10.1111/j.1750-8606.2007.00016.x

Arnett, J. J. (2007). Emerging adulthood: What is it, and what is it good for? *Child Development Perspectives, 1*(2), 68–73.

Asato, M. R., Terwilliger, R., Woo, J., & Luna, B. S. (2010). White matter development in adolescence: A DTI study. *Cerebral Cortex, 20*(9), 2122–2131. https://doi.org/10.1093/cercor/bhp282

Avenevoli, S., & Steinberg, L. (2001). The continuity of depression across the adolescent transition. In H. W. Reese & R. Kail (Eds.), *Advances in child development and behavior* (pp. 139–173). San Diego, CA: Academic Press.

Axelson, D. A., Bertocci, M. A., Lewin, D. S., Trubnick, L. S., Birmaher, B., Williamson, D. E., … Dahl, R. E. (2003). Measuring mood and com-

plex behavior in natural environments: Use of ecological momentary assessment in pediatric affective disorders. *Journal of Child and Adolescent Psychopharmacology, 13*(3), 253–266. https://doi.org/10.1089/104454603322572589

Bandura, A. (1964). The stormy decade: Fact or fiction? *Psychology in the Schools, 1*(3), 224–231. https://doi.org/10.1002/1520-6807(196407)1:3<224::AID-PITS2310010303>3.0.CO;2-I

Barrett, L. F., Lane, R. D., Sechrest, L., & Schwartz, G. E. (2000). Sex differences in emotional awareness. *Personality and Social Psychology Bulletin, 26*(9), 1027–1035. https://doi.org/10.1177/01461672002611001

Beauchaine, T. P., Gatzke-Kopp, L., & Mead, H. K. (2007). Polyvagal theory and developmental psychopathology: Emotion dysregulation and conduct problems from preschool to adolescence. *Biological Psychology, 74*(2), 174–184. https://doi.org/10.1016/j.biopsycho.2005.08.008

Beckes, L., & Coan, J. A. (2011). Social baseline theory: The role of social proximity in emotion and economy of action. *Social and Personality Psychology Compass, 5*(12), 976–988. https://doi.org/10.1111/j.1751-9004.2011.00400.x

Bender, H. L., Allen, J. P., McElhaney, K. B., Antonishak, J., Moore, C. M., Kelly, H. O., & Davis, S. M. (2007). Use of harsh physical discipline and developmental outcomes in adolescence. *Development and Psychopathology, 19*(1), 227–242. https://doi.org/10.1017/S0954579407070125

Bender, P. K., Reinholdt-Dunne, M. L., Esbjørn, B. H., & Pons, F. (2012). Emotion dysregulation and anxiety in children and adolescents: Gender differences. *Personality and Individual Differences, 53*(3), 284–288. https://doi.org/10.1016/j.paid.2012.03.027

Berndt, T. J. (2002). Friendship quality and social development. *Current Directions in Psychological Science, 11*(1), 7–10. https://doi.org/10.1111/1467-8721.00157

Betts, J., Gullone, E., & Allen, J. S. (2009). An examination of emotion regulation, temperament, and parenting style as potential predictors of adolescent depression risk status: A correlational study. *British Journal of Developmental Psychology, 27*(2), 473–485. https://doi.org/10.1348/026151008X314900

Birditt, K. S., & Fingerman, K. L. (2003). Age and gender differences in adults' descriptions of emotional reactions to interpersonal problems. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 58*(4), 237–245. https://doi.org/10.1093/geronb/58.4.P237

Bjork, J. M., Smith, A. R., Chen, G., & Hommer, D. W. (2010). Adolescents, adults and rewards: Comparing motivational neurocircuitry recruitment using fMRI. *PLoS One, 5*(7), e11440. https://doi.org/10.1371/journal.pone.0011440

Blanchard-Fields, F., & Coats, A. H. (2008). The experience of anger and sadness in everyday problems impacts age differences in emotion regulation. *Developmental Psychology, 44*(6), 1547–1556. https://doi.org/10.1037/a0013915

Blyth, D. A., Simmons, R. G., & Zakin, D. F. (1985). Satisfaction with body image for early adolescent females: The impact of pubertal timing within different school environments. *Journal of Youth and Adolescence, 14*(3), 207–225. https://doi.org/10.1007/bf02090319

Bolling, D. Z., Pitskel, N. B., Deen, B., Crowley, M. J., Mayes, L. C., & Pelphrey, K. A. (2011). Development of neural systems for processing social exclusion from childhood to adolescence. *Developmental Science, 14*(6), 1431–1444. https://doi.org/10.1111/j.1467-7687.2011.01087.x

Bonanno, G. A., Colak, D. M., Keltner, D., Shiota, M. N., Papa, A., Noll, J. G., … Trickett, P. K. (2007). Context matters: The benefits and costs of expressing positive emotion among survivors of childhood sexual abuse. *Emotion, 7*(4), 824–837. https://doi.org/10.1037/1528-3542.7.4.824

Booth, A., Johnson, D. R., Granger, D. A., Crouter, A. C., & McHale, S. (2003). Testosterone and child and adolescent adjustment: The moderating role of parent-child relationships. *Developmental Psychology, 39*(1), 85–98. https://doi.org/10.1037/0012-1649.39.1.85

Brody, L. R., & Hall, J. A. (2010). Gender, emotion, and socialization. In J. C. Chrisler & D. R. McCreary (Eds.), *Handbook of gender research in psychology* (pp. 429–454). New York, NY: Springer-Verlag.

Bronstein, P., Briones, M., Brooks, T., & Cowan, B. (1996). Gender and family factors as predictors of late adolescent emotional expressiveness and adjustment: A longitudinal study. *Sex Roles, 34*(11–12), 739–765. https://doi.org/10.1007/BF01544314

Brown, B. B. (2004). Adolescents' relationships with peers. In R. Lerner & L. Steinberg (Eds.), *Handbook of adolescent psychology* (Vol. 2, 2nd ed., pp. 363–394). Hoboken, NJ: Wiley.

Brown, B. B., & Larson, J. (2009). Peer relationships in adolescence. In *Handbook of adolescent psychology* (pp. 74–103). Wiley. https://doi.org/10.1002/9780470479193.adlpsy002004

Brown, J. S., Meadows, S. O., & Elder, G. H., Jr. (2007). Race-ethnic inequality and psychological distress: Depressive symptoms from adolescence to young adulthood. *Developmental Psychology, 43*(6), 1295–1311. https://doi.org/10.1037/0012-1649.43.6.1295

Buchanan, C. M., Eccles, J. S., & Becker, J. B. (1992). Are adolescents the victims of raging hormones? Evidence for activational effects of hormones on moods and behavior at adolescence. Psychological Bulletin, 111(1), 62–107. https://doi.org/10.1037/0033-2909.111.1.62

Buhrmester, D. (1998). Need fulfillment, interpersonal competence, and the developmental contexts of early adolescent friendship. In W. M. Bukowski, A. F. Newcomb, & W. W. Hartup (Eds.), *Cambridge studies in social and emotional development. The company they keep: Friendship in childhood and adolescence*

(pp. 158–185). New York, NY: Cambridge University Press.

Bukowski, W. M., Newcomb, A. F., & Hartup, W. W. (1998). *Cambridge studies in social and emotional development. The company they keep: Friendship in childhood and adolescence*. New York, NY: Cambridge University Press.

Burnett, S., Bird, G., Moll, J., Frith, C., & Blakemore, S.-J. (2009). Development during adolescence of the neural processing of social emotion. *Journal of Cognitive Neuroscience, 21*(9), 1736–1750. https://doi.org/10.1162/jocn.2009.21121

Burnett, S., Sebastian, C., Kadosh, K. C., & Blakemore, S.-J. (2011). The social brain in adolescence: Evidence from functional magnetic resonance imaging and behavioural studies. *Neuroscience & Biobehavioral Reviews, 35*(8), 1654–1664. https://doi.org/10.1016/j.neubiorev.2010.10.011

Burwell, R. A., & Shirk, S. R. (2007). Subtypes of rumination in adolescence: Associations between brooding, reflection, depressive symptoms, and coping. *Journal of Clinical Child and Adolescent Psychology, 36*(1), 56–65. https://doi.org/10.1080/15374410709336568

Butler, E. A., Egloff, B., Wlhelm, F. H., Smith, N. C., Erickson, E. A., & Gross, J. J. (2003). The social consequences of expressive suppression. *Emotion, 3*(1), 48–67. https://doi.org/10.1037/1528-3542.3.1.48

Campos, J. J., Walle, E. A., Dahl, A., & Main, A. (2011). Reconceptualizing emotion regulation. *Emotion Review, 3*(1), 26–35. https://doi.org/10.1177/1754073910380975

Casey, B. J., Jones, R. M., & Hare, T. A. (2008). The adolescent brain. *Annals of the New York Academy of Sciences, 1124*(1), 111–126. https://doi.org/10.1196/annals.1440.010

Casey, B. J., Jones, R. M., Levita, L., Libby, V., Pattwell, S. S., Ruberry, E. J., … Somerville, L. H. (2010). The storm and stress of adolescence: Insights from human imaging and mouse genetics. *Developmental Psychobiology, 52*(3), 225–235. https://doi.org/10.1002/dev.20447

Casey, B. J., Tottenham, N., Liston, C., & Durston, S. (2005). Imaging the developing brain: What have we learned about cognitive development? *Trends in Cognitive Sciences, 9*(3), 104–110. https://doi.org/10.1016/j.tics.2005.01.011

Cassano, M., Perry-Parrish, C., & Zeman, J. (2007). Influence of gender on parental socialization of children's sadness regulation. *Social Development, 16*(2), 210–231. https://doi.org/10.1111/j.1467-9507.2007.00381.x

Chandler, M. (1987). The Othello effect. *Human Development, 30*(3), 137–159. https://doi.org/10.1159/000273174

Chaplin, T. M., & Aldao, A. (2013). Gender differences in emotion expression in children: A meta-analytic review. *Psychological Bulletin, 139*(4), 735–765. https://doi.org/10.1037/a0030737

Chaplin, T. M., Cole, P. M., & Zahn-Waxler, C. (2005). Parental socialization of emotion expression: Gender differences and relations to child adjustment. *Emotion, 5*(1), 80–88. https://doi.org/10.1037/1528-3542.5.1.80

Chen, C.-H., Ridler, K., Suckling, J., Williams, S., Fu, C. H. Y., Merlo-Pich, E., & Bullmore, E. (2007). Brain imaging correlates of depressive symptom severity and predictors of symptom improvement after antidepressant treatment. *Biological Psychiatry, 62*(5), 407–414. https://doi.org/10.1016/j.biopsych.2006.09.018

Collins, W. A. (2003). More than myth: The developmental significance of romantic relationships during adolescence. *Journal of Research on Adolescence, 13*(1), 1–24. https://doi.org/10.1111/1532-7795.1301001

Collins, W. A., & Steinberg, L. (2006). Adolescent development in interpersonal context. In N. Eisenberg, R. Fabes, & T. Spinrad (Eds.), *Handbook of child psychology, volume three: Social, emotional, and personality development* (16th ed., pp. 1003–1068). Hoboken, NJ: Wiley. https://doi.org/10.1002/9780470147658.chpsy0316

Crone, E. A., & Dahl, R. E. (2012). Understanding adolescence as a period of social-affective engagement and goal flexibility. *Nature Reviews. Neuroscience, 13*(9), 636–650. https://doi.org/10.1038/nrn3313

Csikszentmihalyi, M., & Larson, R. (1984). *Being adolescent: Conflict and growth in the teenage years*. New York, NY: Basic Books.

Dahl, R. E. (2001). Affect regulation, brain development, and behavioral/emotional health in adolescence. *CNS Spectrums, 6*(1), 60–72. https://doi.org/10.1017/S1092852900022884

Dahl, R. E. (2004). Adolescent brain development: A period of vulnerabilities and opportunities. *Keynote address. Annals of the New York Academy of Sciences, 1021*, 1–22. https://doi.org/10.1196/annals.1308.001

Dahl, R. E., Allen, N. B., Wilbrecht, L., & Suleiman, A. B. (2018). Importance of investing in adolescence from a developmental science perspective. *Nature, 554*(7693), 441–450. https://doi.org/10.1038/nature25770

Davey, C. G., Yücel, M., & Allen, N. B. (2008). The emergence of depression in adolescence: Development of the prefrontal cortex and the representation of reward. *Neuroscience & Biobehavioral Reviews, 32*(1), 1–19. https://doi.org/10.1016/j.neubiorev.2007.04.016

Demir, M., Şimşek, Ö. F., & Procsal, A. D. (2013). I am so happy 'cause my best friend makes me feel unique: Friendship, personal sense of uniqueness and happiness. *Journal of Happiness Studies, 14*(4), 1201–1224. https://doi.org/10.1007/s10902-012-9376-9

Dichter, G. S., Felder, J. N., & Smoski, M. J. (2009). Affective context interferes with cognitive control in unipolar depression: An fMRI investigation. *Journal of Affective Disorders, 114*(1), 131–142. https://doi.org/10.1016/j.jad.2008.06.027

Diener, E., Sandvik, E., & Larsen, R. J. (1985). Age and sex effects for emotional intensity. *Developmental Psychology, 21*(3), 542–546. https://doi.org/10.1037/0012-1649.21.3.542

Donaldson, D., Prinstein, M. J., Danovsky, M., & Spirito, A. (2000). Patterns of children's coping with life stress: Implications for clinicians. *American Journal of*

Orthopsychiatry, 70(3), 351. https://doi.org/10.1037/h0087689

Dorn, L. D., & Biro, F. M. (2011). Puberty and its measurement: A decade in review. *Journal of Research on Adolescence, 21*(1), 180–195. https://doi.org/10.1111/j.1532-7795.2010.00722.x

Durston, S., Thomas, K. M., Yang, Y., Uluğ, A. M., Zimmerman, R. D., & Casey, B. J. (2002). A neural basis for the development of inhibitory control. *Developmental Science, 5*(4). https://doi.org/10.1111/1467-7687.00235

Eaton, D. K., Kann, L., Kinchen, S., Shanklin, S., Flint, K. H., Hawkins, J., … Wechsler, H. (2012). *Youth risk behvior surveillance—United States, 2011*. Retrieved from https://www.cdc.gov/mmwr/preview/mmwrhtml/ss6104a1.htm

Eisenberg, N. (2000). Empathy and sympathy. In M. Lewis & J. M. Haviland-Jones (Eds.), *Handbook of emotions* (pp. 677–693). New York, NY: Guilford Press.

Eisenberg, N., Fabes, R. A., Murphy, B., Karbon, M., Maszk, P., Smith, M., … Suh, K. (1994). The relations of emotionality and regulation to dispositional and situational empathy-related responding. *Journal of Personality and Social Psychology, 66*(4), 776–797. https://doi.org/10.1037/0022-3514.66.4.776

Eisenberg, N., & Lennon, R. (1983). Sex differences in empathy and related capacities. *Psychological Bulletin, 94*(1), 100–131. https://doi.org/10.1037/0033-2909.94.1.100

Else-Quest, N. M., Higgins, A., Allison, C., & Morton, L. C. (2012). Gender differences in self-conscious emotional experience: A meta-analysis. *Psychological Bulletin, 138*(5), 947–981. https://doi.org/10.1037/a0027930

Erikson, E. H. (1959). Identity and the life cycle: Selected papers. *Psychological Issues, 2*, 1–171.

Ernst, M., Nelson, E. E., Jazbec, S., McClure, E. B., Monk, C. S., Leibenluft, E., … Pine, D. S. (2005). Amygdala and nucleus accumbens in responses to receipt and omission of gains in adults and adolescents. *NeuroImage, 25*(4), 1279–1291. https://doi.org/10.1016/j.neuroimage.2004.12.038

Ernst, M., Pine, D. S., & Hardin, M. (2006). Triadic model of the neurobiology of motivated behavior in adolescence. *Psychological Medicine, 36*(3), 299–312. https://doi.org/10.1017/S0033291705005891

Ernst, M., Romeo, R. D., & Andersen, S. L. (2009). Neurobiology of the development of motivated behaviors in adolescence: A window into a neural systems model. *Pharmacology Biochemistry and Behavior, 93*(3), 199–211. https://doi.org/10.1016/j.pbb.2008.12.013

Eschenbeck, H., Kohlmann, C.-W., & Lohaus, A. (2007). Gender differences in coping strategies in children and adolescents. *Journal of Individual Differences, 28*(1), 18–26. https://doi.org/10.1027/1614-0001.28.1.18

Fabes, R. A., & Martin, C. L. (1991). Gender and age stereotypes of emotionality. *Personality and Social Psychology Bulletin, 17*(5), 532–540. https://doi.org/10.1177/0146167291175008

Feiring, C. (1996). Concept of romance in 15-year-old adolescents. *Journal of Research on Adolescence, 6*(2), 181–200.

Fernandez-Berrocal, P., Alcaide, R., Extremera, N., & Pizarro, D. (2006). The role of emotional intelligence in anxiety and depression among adolescents. *Individual Differences Research, 4*(1), 16–27. https://doi.org/10.1196/annals.1308.042

Fivush, R., & Buckner, J. P. (2000). Gender, sadness, and depression: The development of emotional focus through gendered discourse. In J. C. Chrisler & D. R. McCreary (Eds.), *Gender and emotion: Social psychological perspectives* (pp. 232–253). New York, NY: Springer-Verlag. https://doi.org/10.1037/a0013970

Forbes, E. E., & Dahl, R. E. (2010). Pubertal development and behavior: Hormonal activation of social and motivational tendencies. *Brain and Cognition, 72*(1), 66–72. https://doi.org/10.1016/j.bandc.2009.10.007

Forbes, E. E., Olino, T. M., Ryan, N. D., Birmaher, B., Axelson, D., Moyles, D. L., & Dahl, R. E. (2010). Reward-related brain function as a predictor of treatment response in adolescents with major depressive disorder. *Cognitive, Affective, & Behavioral Neuroscience, 10*(1), 107–118. https://doi.org/10.3758/CABN.10.1.107

Forbes, E. E., Williamson, D. E., Ryan, N. D., & Dahl, R. E. (2004). Positive and negative affect in depression: Influence of sex and puberty. *Annals of the New York Academy of Sciences, 1021*(1), 341–347. https://doi.org/10.1196/annals.1308.042

Galvan, A. (2010). Adolescent development of the reward system. *Frontiers in Human Neuroscience, 4*. https://doi.org/10.3389/neuro.09.006.2010

Galvan, A., Hare, T. A., Parra, C. E., Penn, J., Voss, H., Glover, G., & Casey, B. J. (2006). Earlier development of the accumbens relative to orbitofrontal cortex might underlie risk-taking behavior in adolescents. *Journal of Neuroscience, 26*(25), 6885–6892. https://doi.org/10.1523/JNEUROSCI.1062-06.2006

Garcia, N. V., & Scherf, K. S. (2015). Emerging sensitivity to socially complex expressions: A unique role for adolescence? *Child Development Perspectives, 9*(2), 84–90. https://doi.org/10.1111/cdep.12114

Garnefski, N., Kraaij, V., & van Etten, M. (2005). Specificity of relations between adolescents' cognitive emotion regulation strategies and internalizing and externalizing psychopathology. *Journal of Adolescence, 28*(5), 619–631. https://doi.org/10.1016/j.adolescence.2004.12.009

Ge, X., Natsuaki, M. N., Neiderhiser, J. M., & Reiss, D. (2009). The longitudinal effects of stressful life events on adolescent depression are buffered by parent–child closeness. *Development and Psychopathology, 21*(2), 621–635. https://doi.org/10.1017/S0954579409000339

Geier, C. F., Terwilliger, R., Teslovich, T., Velanova, K., & Luna, B. (2009). Immaturities in reward processing and its influence on inhibitory control in adolescence. *Cerebral Cortex, 20*(7), 1613–1629. https://doi.org/10.1093/cercor/bhp225

Gilbert, K. E. (2012). The neglected role of positive emotion in adolescent psychopathology. *Clinical Psychology Review, 32*(6), 467–481. https://doi.org/10.1016/j.cpr.2012.05.005

Glied, S., & Pine, D. S. (2002). Consequences and correlates of adolescent depression. *Archives of Pediatrics & Adolescent Medicine, 156*(10), 1009–1014. https://doi.org/10.1001/archpedi.156.10.1009

Gnepp, J., & Hess, D. L. (1986). Children's understanding of verbal and facial display rules. *Developmental Psychology, 22*(1), 103–108. https://doi.org/10.1037/0012-1649.22.1.103

Gogtay, N., Giedd, J. N., Lusk, L., Hayashi, K. M., Greenstein, D., Vaituzis, A. C., … Toga, A. W. (2004). Dynamic mapping of human cortical development during childhood through early adulthood. *Proceedings of the National Academy of Sciences of the United States of America, 101*(21), 8174–8179. https://doi.org/10.1073/pnas.0402680101

Gottlieb, B. H., Still, E., & Newby-Clark, I. R. (2007). Types and precipitants of growth and decline in emerging adulthood. *Journal of Adolescent Research, 22*(2), 132–155. https://doi.org/10.1177/0743558406298201

Graber, J. A., & Sontag, L. M. (2009). Internalizing problems during adolescence. In R. Lerner & L. Steinberg (Eds.), *Handbook of adolescent psychology: Individual bases of adolescent development* (pp. 642–682). Hoboken, NJ: Wiley.

Gratz, K. L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the difficulties in emotion regulation scale. *Journal of Psychopathology and Behavioral Assessment, 26*(1), 41–54. https://doi.org/10.1023/b:joba.0000007455.08539.94

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and Well-being. *Journal of Personality and Social Psychology, 85*(2), 348–362. https://doi.org/10.1037/0022-3514.85.2.348

Gullone, E., Hughes, E. K., King, N. J., & Tonge, B. (2010). The normative development of emotion regulation strategy use in children and adolescents: A 2-year follow-up study. *Journal of Child Psychology and Psychiatry, 51*(5), 567–574. https://doi.org/10.1111/j.1469-7610.2009.02183.x

Gunnar, M. R., Wewerka, S., Frenn, K., Long, J. D., & Griggs, C. (2009). Developmental changes in hypothalamus–pituitary–adrenal activity over the transition to adolescence: Normative changes and associations with puberty. *Development and Psychopathology, 21*(1), 69–85. https://doi.org/10.1017/S0954579409000054

Guyer, A. E., McClure-Tone, E. B., Shiffrin, N. D., Pine, D. S., & Nelson, E. E. (2009). Probing the neural correlates of anticipated peer evaluation in adolescence. *Child Development, 80*(4), 1000–1015. https://doi.org/10.1111/j.1467-8624.2009.01313.x

Guyer, A. E., Monk, C. S., McClure-Tone, E. B., Nelson, E. E., Roberson-Nay, R., Adler, A. D., … Ernst, M. (2008). A developmental examination of amygdala response to facial expressions. *Journal of Cognitive Neuroscience, 20*(9), 1565–1582. https://doi.org/10.1162/jocn.2008.20114

Hall, G. S. (1904). *Adolescence (Vols. 1 & 2)*. New York, NY: Appleton.

Hamilton, J. A., & Jensvold, M. (1992). Personality, psychopathology, and depressions in women. In L. S. Brown & M. Ballou (Eds.), *Personality and psychopathology: Feminist reappraisals* (pp. 116–143). New York, NY: Guilford Press.

Hampel, P., & Petermann, F. (2005). Age and gender effects on coping in children and adolescents. *Journal of Youth and Adolescence, 34*(2), 73–83. https://doi.org/10.1007/s10964-005-3207-9

Hampel, P., & Petermann, F. (2006). Perceived stress, coping, and adjustment in adolescents. *Journal of Adolescent Health, 38*(4), 409–415. https://doi.org/10.1016/j.jadohealth.2005.02.014

Harter, S., & Buddin, B. J. (1987). Children's understanding of the simultaneity of two emotions: A five-stage developmental acquisition sequence. *Developmental Psychology, 23*(3), 388–399. https://doi.org/10.1037/0012-1649.23.3.388

Haviland-Jones, J. M., & Kahlbaugh, P. (2000). Emotion and identity. In M. Lewis & J. M. Haviland-Jones (Eds.), *Handbook of emotions* (pp. 293–305). New York, NY: Guilford Press.

Hay, I., & Ashman, A. F. (2003). The development of adolescents' emotional stability and general self-concept: The interplay of parents, peers, and gender. *International Journal of Disability, Development and Education, 50*(1), 77–91. https://doi.org/10.1080/1034912032000053359

Hazan, C., & Zeifman, D. (1994). Sex and the psychological tether. In K. Bartholomew & D. Perlman (Eds.), *Advances in personal relationships, Attachment processes in adulthood* (Vol. 5, pp. 151–178). London, England: Jessica Kingsley Publishers.

Henker, B., Whalen, C. K., Jamner, L. D., & Delfino, R. J. (2002). Anxiety, affect, and activity in teenagers: Monitoring daily life with electronic diaries. *Journal of the American Academy of Child & Adolescent Psychiatry, 41*(6), 660–670. https://doi.org/10.1097/00004583-200206000-00005

Herba, C., & Phillips, M. (2004). Annotation: Development of facial expression recognition from childhood to adolescence: Behavioural and neurological perspectives. *Journal of Child Psychology and Psychiatry, 45*(7), 1185–1198. https://doi.org/10.1111/j.1469-7610.2004.00316.x

Herts, K. L., McLaughlin, K. A., & Hatzenbuehler, M. L. (2012). Emotion dysregulation as a mechanism linking stress exposure to adolescent aggressive behavior. *Journal of Abnormal Child Psychology, 40*(7), 1111–1122. https://doi.org/10.1007/s10802-012-9629-4

Hill, J. P. (1983). Early adolescence: A research agenda. *The Journal of Early Adolescence, 3*(1–2), 1–21. https://doi.org/10.1177/027243168331002

Hilt, L. M., McLaughlin, K. A., & Nolen-Hoeksema, S. (2010). Examination of the response styles theory in

a community sample of young adolescents. *Journal of Abnormal Child Psychology, 38*(4), 545–556. https://doi.org/10.1007/s10802-009-9384-3

Hoffman, K. B., Cole, D. A., Martin, J. M., Tram, J., & Seroczynski, A. D. (2000). Are the discrepancies between self-and others' appraisals of competence predictive or reflective of depressive symptoms in children and adolescents: A longitudinal study, part II. *Journal of Abnormal Psychology, 109*(4), 651–662. https://doi.org/10.1037/0021-843X.109.4.651

Hofmann, S. G., & Kashdan, T. B. (2010). The affective style questionnaire: Development and psychometric properties. *Journal of Psychopathology and Behavioral Assessment, 32*(2), 255–263. https://doi.org/10.1007/s10862-009-9142-4

Inhelder, B., & Piaget, J. (1958). An essay on the construction of formal operational structures. In A. Parsons & S. Milgram (Eds.), *The growth of logical thinking: From childhood to adolescence*. New York, NY: Basic Books.

Jacobson, K. C., & Rowe, D. C. (1999). Genetic and environmental influences on the relationships between family connectedness, school connectedness, and adolescent depressed mood: Sex differences. *Developmental Psychology, 35*(4), 926–939. https://doi.org/10.1037/0012-1649.35.4.926

John, O. P., & Gross, J. J. (2004). Healthy and unhealthy emotion regulation: Personality processes, individual differences, and life span development. *Journal of Personality, 72*(6), 1301–1334. https://doi.org/10.1111/j.1467-6494.2004.00298.x

Josephs, R. A., Newman, M. L., Brown, R. P., & Beer, J. M. (2003). Status, testosterone, and human intellectual performance: Stereotype threat as status concern. *Psychological Science, 14*(2), 158–163. https://doi.org/10.1111/1467-9280.t01-1-01435

Keating, D. P. (1990). Adolescent thinking. In S. S. Feldman & G. R. Elliott (Eds.), *At the threshold: The developing adolescent* (pp. 54–89). Cambridge, MA: Harvard University Press.

Keating, D. P. (2011). Cognitive development. In B. B. Brown & M. J. Prinstein (Eds.), *Encyclopedia of adolescence* (pp. 106–114). New York, NY: Oxford.

Keedwell, P., Drapier, D., Surguladze, S., Giampietro, V., Brammer, M., & Phillips, M. (2009). Neural markers of symptomatic improvement during antidepressant therapy in severe depression: Subgenual cingulate and visual cortical responses to sad, but not happy, facial stimuli are correlated with changes in symptom score. *Journal of Psychopharmacology, 23*(7), 775–788. https://doi.org/10.1177/0269881108093589

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry, 62*(6), 593–602. https://doi.org/10.1001/archpsyc.62.6.593

Klimes-Dougan, B., Pearson, T. E., Jappe, L., Mathieson, L., Simard, M. R., Hastings, P., & Zahn-Waxler, C. (2014). Adolescent emotion socialization: A longitudinal study of friends' responses to negative emotions. *Social Development, 23*(2), 395–412. https://doi.org/10.1111/sode.12045

Klimes-Dougan, B., & Zeman, J. (2007). Introduction to the special issue of social development: Emotion socialization in childhood and adolescence. *Social Development, 16*(2), 203–209. https://doi.org/10.1111/j.1467-9507.2007.00380.x

Kuhn, D. (2009). Adolescent thinking. In R. Lerner & L. Steinberg (Eds.), *Handbook of adolescent psychology* (pp. 152–186). Hoboken, NJ: Wiley. https://doi.org/10.1002/9780470479193.adlpsy001007

La Greca, A. M., & Harrison, H. M. (2005). Adolescent peer relations, friendships, and romantic relationships: Do they predict social anxiety and depression? *Journal of Clinical Child and Adolescent Psychology, 34*(1), 49–61. https://doi.org/10.1207/s15374424jccp3401_5

Labouvie-Vief, G. (1980). Beyond formal operations: Uses and limits of pure logic in life-span development. *Human Development, 23*(3), 141–161. https://doi.org/10.1159/000272546

Lanteigne, D. M., Flynn, J. J., Eastabrook, J. M., & Hollenstein, T. (2014). Discordant patterns among emotional experience, arousal, and expression in adolescence: Relations with emotion regulation and internalizing problems. *Canadian Journal of Behavioural Science/Revue Canadienne Des Sciences Du Comportement, 46*(1), 29–39. https://doi.org/10.1037/a0029968

Larson, R. W. (2011). Positive development in a disorderly world. *Journal of Research on Adolescence, 21*(2), 317–334. https://doi.org/10.1111/j.1532-7795.2010.00707.x

Larson, R. W., & Asmussen, L. (1991). Anger, worry, and hurt in early adolescence: An enlarging world of negative emotions. In M. E. Colten & S. Gore (Eds.), *Adolescent stress: Causes and consequences* (pp. 21–41). New York, NY: Aldine de Gruyter.

Larson, R. W., Clore, G. L., & Wood, G. A. (1999). The emotions of romantic relationships: Do they wreak havoc on adolescents. In W. Furman, B. B. Brown, & C. Feiring (Eds.), *The development of romantic relationships in adolescence* (pp. 19–49). New York, NY: Cambridge University Press.

Larson, R. W., Moneta, G., Richards, M. H., & Wilson, S. (2002). Continuity, stability, and change in daily emotional experience across adolescence. *Child Development, 73*(4), 1151–1165. https://doi.org/10.1111/1467-8624.00464

Larson, R. W., Raffaelli, M., Richards, M. H., Ham, M., & Jewell, L. (1990). Ecology of depression in late childhood and early adolescence: A profile of daily states and activities. *Journal of Abnormal Psychology, 99*(1), 92–102.

Larson, R. W., & Richards, M. H. (1994). Family emotions: Do young adolescents and their parents experience the same states? *Journal of Research on Adolescence, 4*(4), 567–583. https://doi.org/10.1207/s15327795jra0404_8

Laursen, B. (1993). Conflict management among close peers. *New Directions for Child and Adolescent*

Development, 1993(60), 39–54. https://doi.org/10.1002/cd.23219936005

Laursen, B., & Collins, W. A. (1994). Interpersonal conflict during adolescence. *Psychological Bulletin, 115*(2), 197–209.

Laursen, B., & Collins, W. A. (2009). Parent-child relationships during adolescence. In *Handbook of adolescent psychology* (2nd ed., pp. 3–42). Hoboken, NJ: Wiley. https://doi.org/10.1002/9780470479193.adlpsy002002

LeDoux, J. E. (2000). Emotion circuits in the brain. *Annual Review of Neuroscience, 23*(1), 155–184. https://doi.org/10.1146/annurev.neuro.23.1.155

Lonigan, C. J., Phillips, B. M., & Hooe, E. S. (2003). Relations of positive and negative affectivity to anxiety and depression in children: Evidence from a latent variable longitudinal study. *Journal of Consulting and Clinical Psychology, 71*(3), 465–481. https://doi.org/10.1037/0022-006X.71.3.465

Lougheed, J. P., & Hollenstein, T. (2012). A limited repertoire of emotion regulation strategies is associated with internalizing problems in adolescence. *Social Development, 21*(4), 704–721. https://doi.org/10.1111/j.1467-9507.2012.00663.x

Luna, B., Garver, K. E., Urban, T. A., Lazar, N. A., & Sweeney, J. A. (2004). Maturation of cognitive processes from late childhood to adulthood. *Child Development, 75*(5), 1357–1372. https://doi.org/10.1111/j.1467-8624.2004.00745.x

Luna, B., Thulborn, K. R., Munoz, D. P., Merriam, E. P., Garver, K. E., Minshew, N. J., … Sweeney, J. A. (2001). Maturation of widely distributed brain function subserves cognitive development. *NeuroImage, 13*(5), 786–793. https://doi.org/10.1006/nimg.2000.0743

Mahady Wilton, M. M., Craig, W. M., & Pepler, D. J. (2000). Emotional regulation and display in classroom victims of bullying: Characteristic expressions of affect, coping styles and relevant contextual factors. *Social Development, 9*(2), 226–245. https://doi.org/10.1111/1467-9507.00121

Martin, C. A., Kelly, T. H., Rayens, M. K., Brogli, B. R., Brenzel, A., Smith, W. J., & Omar, H. A. (2002). Sensation seeking, puberty, and nicotine, alcohol, and marijuana use in adolescence. *Journal of the American Academy of Child & Adolescent Psychiatry, 41*(12), 1495–1502. https://doi.org/10.1097/00004583-200212000-00022

Masten, C. L., Eisenberger, N., Borofsky, L. A., Pfeifer, J. H., McNealy, K., Mazziotta, J. C., & Dapretto, M. (2009). Neural correlates of social exclusion during adolescence: Understanding the distress of peer rejection. *Social Cognitive and Affective Neuroscience, 4*(2), 143–157. https://doi.org/10.1093/scan/nsp007

Matthews, S. C., Simmons, A. N., Lane, S. D., & Paulus, M. P. (2004). Selective activation of the nucleus accumbens during risk-taking decision making. *Neuroreport, 15*(13), 2123–2127. https://doi.org/10.1097/00001756-200409150-00025

May, J. C., Delgado, M. R., Dahl, R. E., Stenger, V. A., Ryan, N. D., Fiez, J. A., & Carter, C. S. (2004). Event-related functional magnetic resonance imaging of reward-related brain circuitry in children and adolescents. *Biological Psychiatry, 55*(4), 359–366. https://doi.org/10.1016/j.biopsych.2003.11.008

McClure, E. B. (2000). A meta-analytic review of sex differences in facial expression processing and their development in infants, children, and adolescents. *Psychological Bulletin, 126*(3), 424–453. https://doi.org/10.1037/0033-2909.126.3.424

McClure, S. M., Laibson, D. I., Loewenstein, G., & Cohen, J. D. (2004). Separate neural systems value immediate and delayed monetary rewards. *Science, 306*(5695), 503–507. https://doi.org/10.1126/science.1100907

McElhaney, K. B., Allen, J. P., Stephenson, J. C., & Hare, A. L. (2009). Attachment and autonomy during adolescence. In R. M. Lerner & L. Steinberg (Eds.), *Handbook of adolescent psychology* (Vol. 1, pp. 358–403). Hoboken, NJ: Wiley. https://doi.org/10.1002/9780470479193.adlpsy001012

McLaughlin, K. A., Hatzenbuehler, M. L., Mennin, D. S., & Nolen-Hoeksema, S. (2011). Emotion dysregulation and adolescent psychopathology: A prospective study. *Behaviour Research and Therapy, 49*(9), 544–554. https://doi.org/10.1016/j.brat.2011.06.003

McRae, K., Gross, J. J., Weber, J., Robertson, E. R., Sokol-Hessner, P., Ray, R. D., … Ochsner, K. N. (2012). The development of emotion regulation: An fMRI study of cognitive reappraisal in children, adolescents and young adults. *Social Cognitive and Affective Neuroscience, 7*(1), 11–22. https://doi.org/10.1093/scan/nsr093

Merikangas, K. R., He, J., Burstein, M., Swanson, S. A., Avenevoli, S., Cui, L., … Swendsen, J. (2010). Lifetime prevalence of mental disorders in US adolescents: Results from the National Comorbidity Survey Replication–Adolescent Supplement (NCS-A). *Journal of the American Academy of Child & Adolescent Psychiatry, 49*(10), 980–989. https://doi.org/10.1016/j.jaac.2010.05.017

Mezulis, A. H., Abramson, L. Y., Hyde, J. S., & Hankin, B. L. (2004). Is there a universal positivity bias in attributions? A meta-analytic review of individual, developmental, and cultural differences in the self-serving attributional bias. *Psychological Bulletin, 130*(5), 711–747. https://doi.org/10.1037/0033-2909.130.5.711

Mills, K. L., Goddings, A.-L., Clasen, L. S., Giedd, J. N., & Blakemore, S.-J. (2014). The developmental mismatch in structural brain maturation during adolescence. *Developmental Neuroscience, 36*(3–4), 147–160. https://doi.org/10.1159/000362328

Monk, C. S., McClure, E. B., Nelson, E. E., Zarahn, E., Bilder, R. M., Leibenluft, E., … Pine, D. S. (2003). Adolescent immaturity in attention-related brain engagement to emotional facial expressions. *NeuroImage, 20*(1), 420–428. https://doi.org/10.1016/S1053-8119(03)00355-0

Morris, A. S., Silk, J. S., Steinberg, L., Myers, S. S., & Robinson, L. R. (2007). The role of the family context in the development of emotion regulation.

Social Development, 16(2), 361–388. https://doi.org/10.1111/j.1467-9507.2007.00389.x

Motta-Mena, N. V., & Scherf, K. S. (2017). Pubertal development shapes perception of complex facial expressions. *Developmental Science, 20*(4). https://doi.org/10.1111/desc.12451

Narr, R. K., Allen, J. P., Tan, J. S., & Loeb, E. L. (2017). Close friendship strength and broader peer group desirability as differential predictors of adult mental health. *Child Development.* https://doi.org/10.1111/cdev.12905/epdf

Nelson, C. A., Bloom, F. E., Cameron, J. L., Amaral, D., Dahl, R. E., & Pine, D. (2002). An integrative, multidisciplinary approach to the study of brain–behavior relations in the context of typical and atypical development. *Development and Psychopathology, 14*(3), 499–520. https://doi.org/10.1017/S0954579402003061

Nelson, E. E., Leibenluft, E., McClure, E. B., & Pine, D. S. (2005). The social re-orientation of adolescence: A neuroscience perspective on the process and its relation to psychopathology. *Psychological Medicine, 35*(2), 163–174. https://doi.org/10.1017/S0033291704003915

Neumann, A., Van Lier, P. A. C., Frijns, T., Meeus, W., & Koot, H. M. (2011). Emotional dynamics in the development of early adolescent psychopathology: A one-year longitudinal study. *Journal of Abnormal Child Psychology, 39*(5), 657–669. https://doi.org/10.1007/s10802-011-9509-3

Neumann, A., van Lier, P. A. C., Gratz, K. L., & Koot, H. M. (2010). Multidimensional assessment of emotion regulation difficulties in adolescents using the difficulties in emotion regulation scale. *Assessment, 17*(1), 138–149. https://doi.org/10.1177/1073191109349579

Nolen-Hoeksema, S. (1994). An interactive model for the emergence of gender differences in depression in adolescence. *Journal of Research on Adolescence, 4*(4), 519–534. https://doi.org/10.1207/s15327795jra0404_5

Noller, P., & Callan, V. (2015). *The adolescent in the family*. New York, NY: Routledge.

O'Neal, C. R., & Magai, C. (2005). Do parents respond in different ways when children feel different emotions? The emotional context of parenting. *Development and Psychopathology, 17*(2), 467–487. https://doi.org/10.1017/S0954579405050224

Ohannessian, C. M., Lerner, R. M., Lerner, J. V., & von Eye, A. (1999). Does self-competence predict gender differences in adolescent depression and anxiety? *Journal of Adolescence, 22*(3), 397–411. https://doi.org/10.1006/jado.1999.0231

Parker, J. G., Low, C. M., Walker, A. R., & Gamm, B. K. (2005). Friendship jealousy in young adolescents: Individual differences and links to sex, self-esteem, aggression, and social adjustment. *Developmental Psychology, 41*(1), 235–250. https://doi.org/10.1037/0012-1649.41.1.235

Parker, J. G., Rubin, K., Erath, S., Wojslawowicz, J., & Buskirk, A. (2006). Peer relationships, child development, and adjustment: A developmental psychopathology perspective. In D. Cicchetti & D. Cohen (Eds.), *Developmental psychopathology, Theory and method* (Vol. 1, 2nd ed., pp. 96–161). Wiley.

Paus, T., Keshavan, M., & Giedd, J. N. (2008). Why do many psychiatric disorders emerge during adolescence? *Nature Reviews Neuroscience, 9*(12), 947–957. https://doi.org/10.1038/nrn2513

Perry-Parrish, C., & Zeman, J. (2011). Relations among sadness regulation, peer acceptance, and social functioning in early adolescence: The role of gender. *Social Development, 20*(1), 135–153. https://doi.org/10.1111/j.1467-9507.2009.00568.x

Petrides, K. V., Frederickson, N., & Furnham, A. (2004). The role of trait emotional intelligence in academic performance and deviant behavior at school. *Personality and Individual Differences, 36*(2), 277–293.

Pfeifer, J. H., & Allen, N. B. (2012). Arrested development? Reconsidering dual-systems models of brain function in adolescence and disorders. *Trends in Cognitive Sciences, 16*(6), 322–329. https://doi.org/10.1016/j.tics.2012.04.011

Pfeifer, J. H., & Blakemore, S.-J. (2012). Adolescent social cognitive and affective neuroscience: Past, present, and future. *Social Cognitive and Affective Neuroscience, 7*(1), 1–10. https://doi.org/10.1093/scan/nsr099

Pfeifer, J. H., Masten, C. L., Moore, W. E., III, Oswald, T. M., Mazziotta, J. C., Iacoboni, M., & Dapretto, M. (2011). Entering adolescence: Resistance to peer influence, risky behavior, and neural changes in emotion reactivity. *Neuron, 69*(5), 1029–1036. https://doi.org/10.1016/j.neuron.2011.02.019

Pitskel, N. B., Bolling, D. Z., Kaiser, M. D., Crowley, M. J., & Pelphrey, K. A. (2011). How grossed out are you? The neural bases of emotion regulation from childhood to adolescence. *Developmental Cognitive Neuroscience, 1*(3), 324–337. https://doi.org/10.1016/j.dcn.2011.03.004

Polce-Lynch, M., Myers, B. J., Kilmartin, C. T., Forssmann-Falck, R., & Kliewer, W. (1998). Gender and age patterns in emotional expression, body image, and self-esteem: A qualitative analysis. *Sex Roles, 38*(11–12), 1025–1048. https://doi.org/10.1023/A:1018830727244

Quevedo, K. M., Benning, S. D., Gunnar, M. R., & Dahl, R. E. (2009). The onset of puberty: Effects on the psychophysiology of defensive and appetitive motivation. *Development and Psychopathology, 21*(1), 27–45. https://doi.org/10.1017/S0954579409000030

Reimer, M. S. (1996). "Sinking into the ground": The development and consequences of shame in adolescence. *Developmental Review, 16*(4), 321–363. https://doi.org/10.1006/drev.1996.0015

Repetti, R. L., Taylor, S. E., & Seeman, T. E. (2002). Risky families: Family social environments and the mental and physical health of offspring. *Psychological Bulletin, 128*(2), 330–366. https://doi.org/10.1037/0033-2909.128.2.330

Richards, M. H., Crowe, P. A., Larson, R., & Swarr, A. (1998). Developmental patterns and gender differ-

ences in the experience of peer companionship during adolescence. *Child Development, 69*(1), 154–163. https://doi.org/10.1111/j.1467-8624.1998.tb06140.x

Richards, M. H., & Larson, R. W. (1993). Pubertal development and the daily subjective states of young adolescents. *Journal of Research on Adolescence, 3*(2), 145–169. https://doi.org/10.1207/s15327795jra0302_3

Rose, A. J. (2002). Co–rumination in the friendships of girls and boys. *Child Development, 73*(6), 1830–1843. https://doi.org/10.1111/1467-8624.00509

Rosenblum, G. D., & Lewis, M. (1999). The relations among body image, physical attractiveness, and body mass in adolescence. *Child Development, 70*(1), 50–64. https://doi.org/10.1111/1467-8624.00005

Rosenblum, G. D., & Lewis, M. (2003). Emotional development in adolescence. In G. R. Adams & M. D. Berzonsky (Eds.), *Blackwell handbook of adolescence* (pp. 269–289). Malden, MA: Blackwell Publishing. https://doi.org/10.1002/9780470756607.ch13

Rosso, I. M., Young, A. D., Femia, L. A., & Yurgelun-Todd, D. A. (2004). Cognitive and emotional components of frontal lobe functioning in childhood and adolescence. *Annals of the New York Academy of Sciences, 1021*(1), 355–362. https://doi.org/10.1196/annals.1308.045

Royzman, E. B., & Kumar, R. (2001). On the relative preponderance of empathic sorrow and its relation to commonsense morality. *New Ideas in Psychology, 19*(2), 131–144. https://doi.org/10.1016/S0732-118X(00)00020-9

Rubin, K. H., Bukowski, W. M., & Parker, J. G. (2006). Peer interactions, relationships, and groups. In N. Eisenberg (Ed.), *Handbook of child psychology (6: Social)* (pp. 571–645). New York, NY: Wiley. https://doi.org/10.1037/0012-1649.22.1.103

Saarni, C. (1999). *The development of emotional competence*. New York, NY: Guilford.

Sallquist, J. V., Eisenberg, N., Spinrad, T. L., Reiser, M., Hofer, C., Zhou, Q., … Eggum, N. (2009). Positive and negative emotionality: Trajectories across six years and relations with social competence. *Emotion, 9*(1), 15–28.

Savin-Williams, R. C., & Berndt, T. J. (1990). Friendship and peer relations. In S. S. Feldman & G. R. Elliot (Eds.), *At the threshold: The developing adolescent* (pp. 277–307). Cambridge, MA: Harvard University Press.

Savitz, J., & Drevets, W. C. (2009). Bipolar and major depressive disorder: Neuroimaging the developmental-degenerative divide. *Neuroscience & Biobehavioral Reviews, 33*(5), 699–771. https://doi.org/10.1016/j.neubiorev.2009.01.004

Scherf, K. S., Behrmann, M., & Dahl, R. E. (2012). Facing changes and changing faces in adolescence: A new model for investigating adolescent-specific interactions between pubertal, brain and behavioral development. *Developmental Cognitive Neuroscience, 2*(2), 199–219. https://doi.org/10.1016/j.dcn.2011.07.016

Schneiders, J., Nicolson, N. A., Berkhof, J., Feron, F. J., DeVries, M. W., & Van Os, J. (2007). Mood in daily contexts: Relationship with risk in early adolescence. *Journal of Research on Adolescence, 17*(4), 697–722. https://doi.org/10.1111/j.1532-7795.2007.00543.x

Schneiders, J., Nicolson, N. A., Berkhof, J., Feron, F. J., van Os, J., & DeVries, M. W. (2006). Mood reactivity to daily negative events in early adolescence: Relationship to risk for psychopathology. *Developmental Psychology, 42*(3), 543–554. https://doi.org/10.1037/0012-1649.42.3.543

Seiffge-Krenke, I. (2000). Causal links between stressful events, coping style, and adolescent symptomatology. *Journal of Adolescence, 23*(6), 675–691. https://doi.org/10.1006/jado.2000.0352

Seiffge-Krenke, I., Aunola, K., & Nurmi, J. (2009). Changes in stress perception and coping during adolescence: The role of situational and personal factors. *Child Development, 80*(1), 259–279. https://doi.org/10.1111/j.1467-8624.2008.01258.x

Shaw, P., Kabani, N. J., Lerch, J. P., Eckstrand, K., Lenroot, R., Gogtay, N., … Rapoport, J. L. (2008). Neurodevelopmental trajectories of the human cerebral cortex. *Journal of Neuroscience, 28*(14), 3586–3594. https://doi.org/10.1523/JNEUROSCI.5309-07.2008

Sheeber, L. B., Allen, N. B., Leve, C., Davis, B., Shortt, J. W., & Katz, L. F. (2009). Dynamics of affective experience and behavior in depressed adolescents. *Journal of Child Psychology and Psychiatry, 50*(11), 1419–1427. https://doi.org/10.1111/j.1469-7610.2009.02148.x

Shulman, S., Connolly, J., & McIsaac, C. J. (2011). Romantic relationships. In B. B. Brown & M. J. Prinstein (Eds.), *Encyclopedia of adolescence* (Vol. 2, pp. 289–298). New York, NY: Academic Press. https://doi.org/10.1146/annurev.psych.52.1.83

Siegel, J. M., Yancey, A. K., Aneshensel, C. S., & Schuler, R. (1999). Body image, perceived pubertal timing, and adolescent mental health. *Journal of Adolescent Health, 25*(2), 155–165. https://doi.org/10.1016/S1054-139X(98)00160-8

Silk, J. S., Siegle, G. J., Whalen, D. J., Ostapenko, L. J., Ladouceur, C. D., & Dahl, R. E. (2009). Pubertal changes in emotional information processing: Pupillary, behavioral, and subjective evidence during emotional word identification. *Development and Psychopathology, 21*(1), 7–26. https://doi.org/10.1017/S0954579409000029

Silk, J. S., Steinberg, L., & Morris, A. S. (2003). Adolescents' emotion regulation in daily life: Links to depressive symptoms and problem behavior. *Child Development, 74*(6), 1869–1880. https://doi.org/10.1046/j.1467-8624.2003.00643.x

Silvers, J. A., McRae, K., Gabrieli, J. D. E., Gross, J. J., Remy, K. A., & Ochsner, K. N. (2012). Age-related differences in emotional reactivity, regulation, and rejection sensitivity in adolescence. *Emotion, 12*(6), 1235. https://doi.org/10.1037/a0028297

Simmonds, D. J., Hallquist, M. N., Asato, M., & Luna, B. (2014). Developmental stages and sex differences

of white matter and behavioral development through adolescence: A longitudinal diffusion tensor imaging (DTI) study. *NeuroImage, 92*, 356–368. https://doi.org/10.1016/j.neuroimage.2013.12.044

Simmons, R. G., Burgeson, R., Carlton-Ford, S., & Blyth, D. A. (1987). The impact of cumulative change in early adolescence. *Child Development*, 1220–1234. https://doi.org/10.2307/1130616

Simon, R. W., Eder, D., & Evans, C. (1992). The development of feeling norms underlying romantic love among adolescent females. *Social Psychology Quarterly, 55*(1), 29–46. https://doi.org/10.2307/2786684

Somerville, L. H., Jones, R. M., & Casey, B. J. (2010). A time of change: Behavioral and neural correlates of adolescent sensitivity to appetitive and aversive environmental cues. *Brain and Cognition, 72*(1), 124–133. https://doi.org/10.1016/j.bandc.2009.07.003

Sontag, L. M., Graber, J. A., Brooks-Gunn, J., & Warren, M. P. (2008). Coping with social stress: Implications for psychopathology in young adolescent girls. *Journal of Abnormal Child Psychology, 36*(8), 1159–1174. https://doi.org/10.1007/s10802-008-9239-3

Spear, L. P. (2000). The adolescent brain and age-related behavioral manifestations. *Neuroscience & Biobehavioral Reviews, 24*(4), 417–463. https://doi.org/10.1016/S0149-7634(00)00014-2

Stapley, J. C., & Haviland, J. M. (1989). Beyond depression: Gender differences in normal adolescents' emotional experiences. *Sex Roles, 20*(5–6), 295–308.

Steinberg, L. (2008). A social neuroscience perspective on adolescent risk-taking. *Developmental Review, 28*(1), 78–106. https://doi.org/10.1016/j.dr.2007.08.002

Steinberg, L., & Avenevoli, S. (2000). The role of context in the development of psychopathology: A conceptual framework and some speculative propositions. *Child Development, 71*(1), 66–74. https://doi.org/10.1111/1467-8624.00119

Steinberg, L. (2002). *Adolescence* (6th ed.). Boston, MA: McGraw-Hill.

Steinberg, L. (2005). Cognitive and affective development in adolescence. *Trends in Cognitive Sciences, 9*(2), 69–74. https://doi.org/10.1016/j.tics.2004.12.005

Steinberg, L. (2014). *Age of opportunity: Lessons from the new science of adolescence*. New York, NY: Houghton Mifflin Harcourt.

Steinberg, L. (2016). *Adolescence* (11th ed.). New York, NY: McGraw-Hill.

Steinberg, L., Dahl, R., Keating, D. P., Kupfer, D. J., Masten, A. S., & Pine, D. S. (2004). The study of developmental psychopathology in adolescence: Integrating affective neuroscience with the study of context. In D. Cicchetti & D. J. Cohen (Eds.), *Developmental psychopathology: Developmental neuroscience* (2nd ed., pp. 710–741). Hoboken, NJ: Wiley.

Steinberg, L., & Morris, A. S. (2001). Adolescent development. *Annual Review of Psychology, 52*(1), 83–110. https://doi.org/10.1146/annurev.psych.52.1.83

Stroud, L. R., Foster, E., Papandonatos, G. D., Handwerger, K., Granger, D. A., Kivlighan, K. T., & Niaura, R. (2009). Stress response and the adolescent transition: Performance versus peer rejection stressors. *Development and Psychopathology, 21*(1), 47–68. https://doi.org/10.1017/S0954579409000042

Sullivan, H. S. (1953). *The interpersonal theory of psychiatry*. New York, NY: Norton.

Susman, E. J. (1997). Modeling developmental complexity in adolescence: Hormones and behavior in context. *Journal of Research on Adolescence, 7*(3), 283–306. https://doi.org/10.1207/s15327795jra0703_3

Tamm, L., Menon, V., & Reiss, A. L. (2002). Maturation of brain function associated with response inhibition. *Journal of the American Academy of Child & Adolescent Psychiatry, 41*(10), 1231–1238. https://doi.org/10.1097/00004583-200210000-00013

Thurber, C. A. (1995). The experience and expression of homesickness in preadolescent and adolescent boys. *Child Development, 66*(4), 1162–1178. https://doi.org/10.2307/1131805

Urošević, S., Collins, P., Muetzel, R., Lim, K., & Luciana, M. (2012). Longitudinal changes in behavioral approach system sensitivity and brain structures involved in reward processing during adolescence. *Developmental Psychology, 48*(5), 1488–1500. https://doi.org/10.1037/a0027502

Van Leijenhorst, L., Moor, B. G., de Macks, Z. A. O., Rombouts, S. A. R. B., Westenberg, P. M., & Crone, E. A. (2010). Adolescent risky decision-making: Neurocognitive development of reward and control regions. *NeuroImage, 51*(1), 345–355. https://doi.org/10.1016/j.neuroimage.2010.02.038

Vasa, R. A., Pine, D. S., Thorn, J. M., Nelson, T. E., Spinelli, S., Nelson, E., … Mostofsky, S. H. (2011). Enhanced right amygdala activity in adolescents during encoding of positively valenced pictures. *Developmental Cognitive Neuroscience, 1*(1), 88–99. https://doi.org/10.1016/j.dcn.2010.08.004

Vernberg, E. M., Abwender, D. A., Ewell, K. K., & Beery, S. H. (1992). Social anxiety and peer relationships in early adolescence: A prospective analysis. *Journal of Clinical Child Psychology, 21*(2), 189–196. https://doi.org/10.1207/s15374424jccp2102_11

von Salisch, M. (1991). *Kinderfreundschaften: Emotionale Kommunikation im Konflikt*. Göttingen, Germany: Hogrefe.

Walker, E. F., Sabuwalla, Z., & Huot, R. (2004). Pubertal neuromaturation, stress sensitivity, and psychopathology. *Development and Psychopathology, 16*(4), 807–824. https://doi.org/10.1017/S0954579404040027

Weinberg, A., & Klonsky, E. D. (2009). Measurement of emotion dysregulation in adolescents. *Psychological Assessment, 21*(4), 616–621. https://doi.org/10.1037/a0016669

Westenberg, P. M., Drewes, M. J., Goedhart, A. W., Siebelink, B. M., & Treffers, P. D. A. (2004). A developmental analysis of self-reported fears in late childhood through mid-adolescence: Social-evaluative fears on the rise? *Journal of Child Psychology and Psychiatry, 45*(3), 481–495. https://doi.org/10.1111/j.1469-7610.2004.00239.x

Westphal, M., Seivert, N. H., & Bonanno, G. A. (2010). Expressive flexibility. *Emotion, 10*(1), 92–100. https://doi.org/10.1037/a0018420

Whitesell, N. R., & Harter, S. (1996). The interpersonal context of emotion: Anger with close friends and classmates. *Child Development, 67*(4), 1345–1359. https://doi.org/10.1111/j.1467-8624.1996.tb01800.x

Wichstrøm, L. (1999). The emergence of gender difference in depressed mood during adolescence: The role of intensified gender socialization. *Developmental Psychology, 35*(1), 232–245. https://doi.org/10.1037/0012-1649.35.1.232

Wilkinson, R. B. (2010). Best friend attachment versus peer attachment in the prediction of adolescent psychological adjustment. *Journal of Adolescence, 33*(5), 709–717. https://doi.org/10.1016/j.adolescence.2009.10.013

Yang, T. T., Simmons, A. N., Matthews, S. C., Tapert, S. F., Frank, G. K., Max, J. E., … Strigo, I. A. (2010). Adolescents with major depression demonstrate increased amygdala activation. *Journal of the American Academy of Child & Adolescent Psychiatry, 49*(1), 42–51. https://doi.org/10.1016/j.jaac.2009.09.004

Yurgelun-Todd, D. (2007). Emotional and cognitive changes during adolescence. *Current Opinion in Neurobiology, 17*(2), 251–257. https://doi.org/10.1016/j.conb.2007.03.009

Zeman, J., Cassano, M., Perry-Parrish, C., & Stegall, S. (2006). Emotion regulation in children and adolescents. *Journal of Developmental & Behavioral Pediatrics, 27*(2), 155–168. https://doi.org/10.1097/00004703-200604000-00014

Zeman, J., Klimes-Dougan, B., Cassano, M., & Adrian, M. (2007). Measurement issues in emotion research with children and adolescents. *Clinical Psychology: Science and Practice, 14*(4), 377–401. https://doi.org/10.1111/j.1468-2850.2007.00098.x

Zeman, J., & Shipman, K. (1997). Social-contextual influences on expectancies for managing anger and sadness: The transition from middle childhood to adolescence. *Developmental Psychology, 33*(6), 917–924. https://doi.org/10.1037/0012-1649.33.6.917

Zimmer-Gembeck, M. J., Ducat, W., & Collins, W. A. (2011). Development of autonomy. In B. B. Brown & M. J. Prinstein (Eds.), *Encyclopedia of adolescence* (pp. 66–76). New York, NY: Oxford.

Zimmermann, P., & Iwanski, A. (2014). Emotion regulation from early adolescence to emerging adulthood and middle adulthood: Age differences, gender differences, and emotion-specific developmental variations. *International Journal of Behavioral Development, 38*(2), 182–194. https://doi.org/10.1177/0165025413515405

Emotional Development Within the Family Context

Esther M. Leerkes and Lauren G. Bailes

Abstract

In this chapter, we summarize theory and research describing the processes by which children's emotional development is influenced by features of the family context with an emphasis on the first 3 years of life. We begin with a focus on the role of parents including the parent-infant attachment relationship, parental sensitivity, parental emotion socialization, harsh and abusive parenting, and emotion-related parental characteristics. Then, we consider the broader family system including interparental conflict, coparenting quality, and sibling relationships. The outcomes considered include children's emotional reactivity and regulation at the behavioral and physiological level, emotion knowledge, social competence, and behavior problems. Throughout the review, we note child characteristics that moderate the association between family context and children's emotional adjustment with a particular emphasis on children's negative emotional reactivity and gender. We conclude with suggestions for future research in this area.

E. M. Leerkes (✉) · L. G. Bailes
The University of North Carolina at Greensboro, Greensboro, NC, USA
e-mail: emleerke@uncg.edu

Introduction

Infants enter the world largely reliant on parents to regulate their emotions for them and then rapidly shift to more active and independent regulation over the first few years of life (Kopp, 1982), and it has been argued that interactions between infants and caregivers play a critical role in this transition (Sroufe, 2005). Likewise, young children turn to the social world to help them understand their own and others' emotions and use this information to guide their subsequent behavior (Denham, 1998). These experiences have long-term effects on children's emotional development through (a) direct, enduring effects of early experience on later emotional outcomes, (b) indirect or mediated processes, and (c) developmental cascades whereby early experiences and individual differences jointly influence early skill acquisition which in turn predict later outcomes (Cox, Mills-Koonce, Propper, & Gariépy, 2010; Fraley, Roisman, & Haltigan, 2013). As such, the role of parents and families more broadly in children's emotional development has received a good deal of attention. In this chapter, we draw upon multiple perspectives to describe the processes by which the family context influences children's concurrent and subsequent emotional development. We focus on studies in which children's emotion reactivity, regulation, and understanding are outcomes as these are clear indicators of emotional development in early childhood that have

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_24

consequences for subsequent emotional well-being (Denham, 1998; Rothbart & Bates, 2006). We also focus on emotion-related adaptive and maladaptive behaviors, namely social competence and behavior problems which can be viewed as indirect indicators of emotional development.

We begin with a focus on the parent-infant attachment relationship and then turn to parental sensitivity, parental emotion socialization, and harsh and abusive parenting. We conclude this section with an overview of the role of parents' own emotion-related traits, such as depression and emotion dysregulation, in relation to their children's emotional development. Next, we turn to broader family system factors with an emphasis on interparental conflict, followed by brief reviews of the role of coparental and sibling relationships in children's emotional development. We focus primarily on children's family experiences in early childhood and comment briefly on later childhood and adolescence. Throughout the review, we attend to child characteristics, particularly child's negative emotional reactivity, age, and gender, that moderate the association between parenting/family factors and children's emotional adjustment. We conclude with suggestions for future research in this area.

Overview of Key Outcomes

Emotional Reactivity and Regulation Emotional reactivity and regulation are two key aspects of temperament that reflect individual differences in emotion processes (Rothbart & Bates, 2006). Emotional reactivity reflects an individual's behavioral and biological reactions to changes in their environment such as the intensity and duration of their fear and anger responses or their general negative emotionality, as well as their threshold or sensitivity to environmental stimuli. For example, children who are temperamentally fearful demonstrate heightened fear even to mildly novel stimuli such as a puppet show (Buss, 2011). Emotion regulation, on the other hand, is the processes that modulate reactivity (Rothbart & Bates, 2006) and includes behaviors, skills, and strategies that may be automatic or effortful and conscious or unconscious (Calkins & Leerkes, 2010). Importantly, reactive and regulatory responses occur simultaneously and influence one another over time and in the moment. For example, a child who engages in effective regulatory strategies, behaviorally or physiologically, may display lower reactivity in the moment (Calkins, Dedmon, Gill, Lomax, & Johnson, 2002), and children who are less able to regulate their emotions may become more reactive over time (Blandon, Calkins, Keane, & O'Brien, 2010).

Early temperament theories emphasized the biological/genetic basis of temperament and stability over time, particularly for reactivity (Rothbart & Bates, 2006). However, contemporary theories have evolved given strong empirical evidence which indicates that both reactivity and regulation develop over time and are influenced by the environment, including the family context (Shiner et al., 2012). Understanding the family factors that support children's adaptive emotional reactivity and regulation is of paramount importance because both have been linked with subsequent adaptive outcomes including fewer mental and physical health problems, academic success, and positive social relationships (Buss, Morales, Cho, & Philbrook, 2015; Gangel et al., 2017; Rothbart & Bates, 2006; Stifter and Augustine, Chap. 16, this volume).

In our review, we consider both behavioral and physiological indices of negative emotional reactivity and its regulation. Behavioral indicators include parental/caregiver report and/or direct observation of expressed negative emotion (e.g., crying, negative facial expressions, tantrums) and the extent to which children use specific regulatory behaviors such as self-soothing, distraction, and help-seeking or appear well-regulated in the face of stress. The primary physiological indices under consideration include cortisol and vagal tone because they are closely tied with emotional reactivity and regulation in the moment and over time as outlined below.

Cortisol measures reflect functioning in the hypothalamic pituitary adrenal (HPA) system. When exposed to stress, the HPA axis is

activated and a hormonal cascade is set into motion typically resulting in the release of cortisol (see Koss & Gunnar, 2017, for a review). Generally, an increase in cortisol in response to a stressor (i.e., reactivity) followed be a return to baseline (i.e., recovery) is adaptive. Notably, higher baseline cortisol and cortisol reactivity are associated with emotional reactivity, particularly fearfulness, both concurrently (Buss, Davidson, Kalin, & Goldsmith, 2004) and longitudinally (Mackrell et al., 2014). Additionally, two atypical patterns of cortisol responding, both linked with chronic stress exposure, may also reflect individual differences in emotional reactivity. *Hypercortisolism,* characterized by exaggerated cortisol reactivity, may reflect heightened sensitivity/reactivity to stressors, and *hypocortisolism,* characterized by lower basal cortisol upon awakening as well as a blunted cortisol stress response, may reflect less sensitivity/reactivity to stressors. Both patterns are linked with maladaptive emotional outcomes (Koss & Gunnar, 2017).

Vagal withdrawal, an indicator of Parasympathetic Nervous System functioning, reflects regulation of the heart by the vagus nerve when faced with challenge (Porges, 2007). Under typical conditions, a slow, steady resting heart rate is adaptive, and this is facilitated by high vagal control of the heart. When confronted with a challenge, vagal withdrawal, or the release of vagal control of the heart, facilitates an increase in heart rate which in turn supports active efforts cope. Thus, high baseline vagal tone and a decrease in vagal tone when confronted with a stressor are both viewed as adaptive, emotion-related, physiological responses. In fact, high baseline vagal tone is associated with easy temperament/low reactivity and emotional well-being, and vagal withdrawal in response to a stressor is associated with effective emotion regulation behaviors both concurrently and longitudinally (Calkins, 1997; Morales and Fox, Chap. 4, this volume; Propper & Holochwost, 2013). Vagal responses are typically quantified via respiratory sinus arrhythmia (RSA) or heart rate variability at the frequency of spontaneous breathing (Porges, 2007).

Emotion Understanding In addition to emotional reactivity and regulation, the extent to which children understand their emotions is a critical aspect of emotional development. Emotion understanding includes children's ability to accurately label their own and others' emotional states, understand the causes and consequences of emotions, and comprehend how emotion influences their own and others' behavior (Denham, 1998). Greater emotion understanding predicts subsequent social competence, school success, emotional intelligence, and mental health (Campbell, Moore, Northrup, & Brownell, 2017; Denham, Bassett, & Brown, 2015; Mayer, Salovey, & Caruso, 1997). Emotion understanding is typically assessed via children's responses to images of emotion faces and vignettes/stories about emotion experiences.

Behavior Problems and Social Competence Beyond the direct indices of emotional development discussed above, behavior problems and social competence reflect maladaptive and adaptive emotion process, respectively, and thus are of interest when considering the role of the family in emotional development. To elaborate, behavior problems include internalizing behaviors, such as anxiety, social withdrawal, and depression; and externalizing behaviors, such as aggression, defiance, destructive behaviors, and conduct problems (Achenbach, Edelbrock, & Howell, 1987). Behavior problems are believed to stem from multiple risk factors including heightened reactivity and emotion regulation deficits (Cicchetti & Rogosch, 2002; Sroufe & Rutter, 1984) or to reflect children's maladaptive attempts to regulate emotions (Calkins, 1994). Likewise, socially competent behavior with peers and adults, such as sharing, helping, empathic responding, and positive peer relations, is believed to reflect many underlying skills, including adaptive emotion regulation and emotion understanding (Brownell, Nichols, & Svetlova, 2013). Notably, early behavior problems and social competence are somewhat stable over time (Knafo & Plomin, 2006; Mesman, Bongers, & Koot, 2001), thus identifying their

roots in early family relationships is of critical importance. We begin our review of the effects of family context on children's emotional development by focusing on the role of infants' emerging attachments to their parents in relation to these outcomes.

Emotional Development Within the Parent-Child Relationship

Infant-Parent Attachment and Children's Emotional Development

Overview of Attachment Theory and Methods John Bowlby (1969) defined attachment as a behavioral adaptation that reflects the bond between the child and caregiver that is critical for survival. Infants strive for consistency and safety with the caregiver, and when these needs are met, self-exploration of the environment can occur (Bowlby, 1980). Throughout early infancy, the quality of attachment and of the relationship with the caregiver influence the infant's behaviors, thoughts, and feelings through the development of internal working models, a schema about the self in relation to the world. Infants with responsive caregivers who adequately meet their needs develop secure internal working models characterized by feelings of trust in others to meet their needs and the belief that they deserve to be cared for appropriately. Conversely, infants that do not have responsive and consistent caregiving may develop insecure internal working models characterized by feelings of rejection and mistrust in others and a sense that they are unworthy of care and protection. These internal working models become a lens which guides infants' expectations for and interpretations of the behavior of their social partners and influences their own behavior within relationships, including their emotion expression and regulation.

Mary Ainsworth and colleagues were the first to empirically test the core propositions of attachment theory (Ainsworth, Blehar, Waters, & Wall, 1978). By directly observing the quality of parenting infants received from their mothers throughout the first year of life, they operationalized the concept of maternal sensitivity as the mothers' ability to accurately interpret the infants' signals and respond contingently and appropriately given the context and developmental status of the infant (Ainsworth et al., 1978). Further, Ainsworth developed an empirical assessment of the nature of the mother-child attachment relationship in a standardized task known as the Strange Situation (Ainsworth et al., 1978). The Strange Situation consists of eight episodes spanning across 20 minutes that are designed to evoke the attachment relationship. The episodes are increasingly stressful for the infant, including a stranger attempting to interact with the infant, the mother leaving the infant with the stranger, and then the stranger and mother leaving the infant in the room alone. Three distinct classifications of attachment emerged based on children's behavior in this task, particularly during the two epidotes in which they were reunited with their mothers (Ainsworth et al., 1978): secure, insecure avoidant, and insecure resistant. Secure infants used the mother as a "secure base" from which to explore their environment by looking toward their mother for reassurance and returning to their parent if they became too wary. During the separation episodes, infant distress increased for many secure infants and upon reunion, secure infants sought proximity and contact with their mothers and appeared comforted by doing so. Infants in the insecure-avoidant group were likely to give mothers little attention when exploring the new environment. During the separation episodes, these infants showed little distress and ignored or avoided the mother upon return. Infants who were insecure resistant tended to engage in very little exploration of the environment, and upon separation, infant distress increased. When the mother returned, these infants were not easily soothed, and both sought contact with the caregiver and displayed resistant or ambivalent behavior by hitting and pushing mothers away. Ainsworth noted that in the prior year, securely attached infants had highly sensitive mothers

who attended to their signals consistently and appropriately. Insecure-avoidant infants had mothers who rejected them or ignored their signals, including distress signals. Insecure-resistant infants had mothers who were inconsistent in parenting. For example, their mothers may have attempted to sooth them, but efforts were slow and ineffective (Ainsworth et al., 1978).

Drawing from Ainsworth's and subsequent research using these methods, Main and Solomon (1990) noted that although most infants could be classified into one of these categories, some were not, and they shared a common set of characteristics. These infants were often contradictory in behavior (e.g., walking toward their mother backwards), exhibited incomplete and frozen movements, and were apprehensive toward the parent (Main & Solomon, 1990). Given the lack of a clear goal in their behavior, these infants were classified as disorganized. Extensive research has been done using a coding scheme developed by Main and Solomon to assess disorganized attachment (Lyons-Ruth & Jacobvitz, 2016; Main & Hesse, 1990; Main & Solomon, 1990). Meta-analyses examining predictors of attachment security for both mothers and fathers have shown that sensitive parenting is a consistent predictor of a secure attachment, whereas disorganized attachment security has been predicted by neglectful or egregiously insensitive parenting, unresolved parental loss or trauma, and parental mental health difficulties (Cyr, Euser, Bakermans-Kranenburg, & van IJzendoorn, 2010; van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999).

In the last 50 years, a number of researchers have utilized these and related methods to better understand the developmental implications of the early infant-parent attachment relationship for children. Although this relationship develops early, attachment security has the potential to impact children's emotional and social competency throughout development. For example, extensive evidence exists linking individual differences in infant-parent attachment to subsequent emotion expression and regulation, internalizing and externalizing behavior problems, and compliance behaviors (Thompson, 2016). In addition to the behavioral assessment of attachment used in early childhood, many researchers have utilized self-report or interview-based measures of attachment security among older children and adolescents. Aside from the Strange Situation paradigm, one of the most common attachment assessments is the Adult Attachment Interview (AAI; Main & Goldwyn, 1984). The AAI has often been modified to be used to assess early parent-child attachment in middle and late childhood, as well as in adolescence (Morris, Silk, Steinberg, Myers, & Robinson, 2007). In the following sections, we summarize the literature that has utilized one of these, or other, common attachment assessments organized by type of child outcome.

Attachment and Emotion Regulation Scholars and clinicians have been particularly interested in potential associations between infant-parent attachment and children's regulation of emotion. In an influential paper, Cassidy (1994) proposed that infants learn to express and regulate their emotions in a manner that fits their caregivers' preferences which they learn based upon their caregivers' responses to their emotion signals. Cassidy (1994) suggested that given secure infants typically experienced sensitive responding to the full range of emotions, they learn to openly express positive and negative emotions and rely on caregivers for assistance regulating emotions. Infants classified as insecure avoidant, who experience parental nonresponsiveness to distress signals, minimize the outward display of negative emotions and turn to caregivers less for assistance regulating their distress to decrease the likelihood of being ignored or rejected by the caregiver. These infants also suppress displaying positive emotions, such as joy, to avoid investing themselves into the relationship in which they cannot count on the caregiver to meet their needs. Although avoidant infants minimize the display of emotions, there is evidence that they are aroused during times of distress as evidenced by their heart rate and cortisol levels (Spangler & Grossman, 1999). Insecure-resistant infants may maximize their levels of distress in order to pro-

vide clearer signals to their inconsistent caregiver. Additionally, these infants may be distressed for extensive periods of time to promote the continued contact between infant and attachment figure. Although these strategies of minimizing and maximizing emotional display may be adaptive for achieving contact with attachment figures, there are long-term negative consequences beyond infancy and outside of the attachment relationship (Cassidy, 1994).

A good deal of empirical evidence supports Cassidy's (1994) perspective. For example, securely attached infants are more likely to use regulatory strategies that are caregiver-oriented, including social referencing and proximity seeking (Diener, Mangelsdorf, McHale, & Frosch, 2002; Schieche & Spangler, 2005), and appear better regulated than insecure infants both as observed in stressful laboratory tasks and as reported by mothers (Qu, Leerkes, & King, 2016). Avoidant infants use active mother-oriented regulation strategies like approaching or playing with the mother less frequently and use a lower variety of mother-oriented regulation behaviors than both secure and resistant infants (Leerkes & Wong, 2012; Qu et al., 2016). Avoidant infants also engage in more self-soothing and solitary toy play during distressing tasks than other infants (Braungart & Stifter, 1991; Diener et al., 2002; Leerkes & Wong, 2012; Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996; Schieche & Spangler, 2005). Resistant infants display more distress, engage in higher levels of passive mother-oriented behaviors (e.g., sitting on the mothers' lap), and use more maladaptive behaviors such as venting and withdrawal and a lower variety of adaptive behaviors such as looking away from the stressor (Leerkes & Wong, 2012). Resistant infants also have poorer mother-reported emotion regulation skills than other preschoolers (Qu et al., 2016).

In addition to behavioral emotion regulation, there is also evidence suggesting that attachment security influences physiological reactivity and regulation. Allostatic load, or the impact on the body caused by fluctuations between stress and regulation, is a normal phenomenon, but can also put stress on the body if the fluctuation is frequent (Blair et al., 2008). Infants classified as insecure avoidant are more likely to show higher allostatic load compared to securely attached infants. This high allostatic load is characterized by higher sympathetic arousal and greater vagal withdrawal, indicating that it may be more difficult for these infants to regulate their distress (Hill-Soderlund et al., 2008). Further, compared to securely attached infants, insecurely attached infants have higher levels of cortisol during times of distress (Ahnert, Gunnar, Lamb, & Barthel, 2004; Fox & Hane, 2008). This pattern of high cortisol during distressing episodes is even stronger among disorganized infants (Bernard & Dozier, 2010). Notably, associations between infant behavior and cortisol responding during the Strange Situation vary based on attachment status, such that for insecure infants only, high cortisol responding is associated with less observable distress (Beijers, Riksen-Walraven, Sebesta, & de Weerth, 2017). This pattern is highly consistent with the view that avoidant infants may mask their distress, and doing so may come at a physiological cost that undermines emotional development over time. It is also notable that high-risk infants in dyads that were randomly assigned to an intervention designed to increase secure attachment demonstrated more typical diurnal cortisol patterns over time compared to a control group (Bernard, Dozier, Bick, & Gordon, 2015). The results of this experimental design lend strong support to the view that infant-parent attachment quality affects emotion regulation.

As children age, there is a notable shift from children depending on their parents for emotional guidance to depending on peers (Allen, 2008). Yet, the effects of the parent-child attachment relationship are still apparent in relation to emotional reactivity and regulation. For example, securely attached children aged 9–11 were found to display more positive emotion and more constructive coping mechanisms when upset and to better regulate negative emotions in a classroom setting compared to insecurely attached children (Kerns, Abraham, Schlegelmilch, & Morgan, 2007). Additionally, children who were insecure resistant or disorganized had higher lev-

els of displayed negative affect, compared to the other attachment classifications (Kerns et al., 2007). Further, insecurely attached children in this age range have been found to display higher emotional dysregulation and emotional suppression compared to securely attached children (Brenning, Soenens, Braet, & Bosmans, 2011).

Attachment and Emotion Understanding In addition to emotion regulation, early attachment has been found to be associated with emotion understanding, although this association has not been studied as extensively. In short, it has been argued that insecurely attached children may have difficulty recognizing, interpreting, and understanding their own and others' emotions, given their history of not having their emotional needs met. For example, children with an insecure attachment to their mothers as infants are less accurate at labeling facial expressions of emotion and understanding the causes of emotions (Raikes & Thompson, 2006; Steele, Steele, & Croft, 2008). Notably, insecure-avoidant children display a positivity bias and are successful in identifying positive emotions (Brumariu, Kerns, & Seibert, 2012). For these children, positivity may be used to facilitate interactions with their caregivers who demonstrate preferential responding to nondistress. Surprisingly, however, disorganized children (aged 3–11) do not have difficulty interpreting and recognizing emotions when compared to securely attached children (Pollak, Cicchetti, Hornung, & Reed, 2000; Steele et al., 2008). Finally, a recent meta-analysis demonstrated a medium effect-size positive association between attachment security and emotion understanding in studies of children under the age of 18 (Cooke, Stuart-Parrigon, Movahed-Abtahi, Koehn, & Kerns, 2016).

Attachment and Behavior Problems/Social Competence The quality of infant-parent attachment relationships has also been implicated in the onset of behavior problems among young children. The development of internalizing disorders has been hypothesized to stem from the presence of an insecure attachment to a caregiver due to the insecure internal working model (Buist, Deković, Meeus, & van Aken, 2004; Madigan, Atkinson, Laurin, & Benoit, 2013). Insecure children may be uncertain about their caregivers' responses which may lead them to become overly dependent on the caregiver and reduce the extent to which they engage in self-exploration (Bowlby, 1973). Further, insecure attachment may lead to social isolation and a functional dependence on the caregiver (Moss, Parent, Gosselin, Rousseau, & St-Laurent, 1996). That is, insecure children may be uncertain about whether their needs will be met by others even outside of the attachment relationship, and therefore, they may struggle to develop other meaningful relationships contributing to social withdrawal. Consistent with this view, a recent meta-analysis demonstrated that children aged 2–5 years old with an insecure attachment to a caregiver are twice as likely to develop internalizing disorders compared to securely attached children (Madigan et al., 2013). However, a more recent meta-analysis indicates that the nature of the association between attachment and internalizing varies depending on type of insecure attachment such that avoidance is a stronger predictor of internalizing than is resistance (Groh, Fearon, IJzendoorn, Bakermans-Kranenburg, & Roisman, 2017). Additionally, recent work has been focused on identifying moderators of this relationship (Groh et al., 2017; Madigan et al., 2013). For example, child gender has been consistently found as a moderator for the associations between attachment and internalizing problems (Bar-Haim, Dan, Eshel, & Sagi-Schwartz, 2007; Fearon, Bakermans-Kranenburg, van IJzendoorn, Lapsley, & Roisman, 2010). When insecurely attached, boys are more likely to develop internalizing behavior problems than girls. This could be attributed to boys' diminished ability to deal with negative emotions compared to girls, which may be amplified by an insecure attachment (Madigan et al., 2013; Zahn-Waxler, Shirtcliff, & Marceau, 2008). Additional moderators that need further study include risk status, such as family socioeconomic status and parental psychopathology (Madigan et al., 2013; van IJzendoorn & Kroonenberg, 1988).

Similar effects have been found when examining the relationship between attachment and internalizing behaviors in later childhood and adolescence. Researchers have theorized that a secure parent-child attachment in emerging adolescence and beyond can help adolescents navigate the many challenges they face (Buist et al., 2004). Although few studies have examined longitudinal effects of infant attachment to adolescent internalizing behavior problems, two studies showed support for the relationship between attachment insecurity during infancy and internalizing behavior problems in high school (Carlson, 1998; Warren, Huston, Egeland, & Sroufe, 1997). Specifically, insecure-avoidant attachment (Warren et al., 1997) and disorganized attachment predicted internalizing problems in high school (Carlson, 1998). In addition to behavioral assessments of attachment, many studies that examine these effects in adolescence have used self-report or interview to assess attachment. Even though the methods may vary, similar patterns are reflected, such that insecure attachments are associated with internalizing problems (Brumariu & Kerns, 2010; Buist et al., 2004).

The manifestation of externalizing behavior problems also has clear roots in attachment theory. An insecure internal working model can lead the child to have depleted trust in others and limited social support (Dodge & Coie, 1987; Lamb, Thompson, Gardner, Charnov, & Estes, 1984). This may contribute to an inability to develop meaningful friendships and trust in authority figures, which may lead to the development of externalizing problems, such as aggression and conduct problems. Consistent with this view, insecure parent-child attachment has been linked to higher rates of conduct problems (Fearon et al., 2010). However, children who have a disorganized attachment are at the highest risk to develop externalizing disorders, and insecure-avoidant and insecure-resistant children have similar risk levels compared to securely attached children (Burgess, Marshall, Rubin, & Fox, 2003; Fearon et al., 2010).

Additionally, several factors have been found to be significant moderators of this association. In particular, the association between insecure attachment and externalizing symptoms is stronger for boys than for girls (Fearon et al., 2010; Pierrehumbert, Miljkovitch, Plancherel, Halfon, & Ansermet, 2000). This pattern could be attributed to gender differences in aggressive behavior such that boys engage in more physical aggression, which is more frequently measured, and girls engage in more relational aggression, which is less frequently measured in early childhood (Crick & Grotpeter, 1995). Additionally, temperament has been found to be a significant and relatively consistent moderator, such that uninhibited children who have insecure-avoidant attachments are more likely to display externalizing behaviors than insecure-avoidant children who are higher in inhibition (Burgess et al., 2003; Pierrehumbert et al., 2000). It is also possible that there are age-related differences in this effect given evidence from one cross-lagged study that attachment security, assessed by a self-report of felt security at age 13, was found to be associated with concurrent and longitudinal reports of fewer externalizing problems at age 14, but this association was not found from age 14 to age 15 (Buist et al., 2004).

Attachment has also been considered as a predictor of children's social competence. There is evidence that within the family context, attachment is linked with less prosocial behavior toward family members. For example, having an insecure attachment to mothers is associated with older siblings' more negative and less prosocial behavior toward their younger siblings (Volling, 2001). Likewise, insecurely attached children who are high on negative emotionality are more defiant and less compliant when their mothers ask them to clean up toys (Kochanska, Aksan, & Carlson, 2005; Lickenbrock et al., 2013). Outside of the family context, studies examining the link between attachment and early prosocial behavior have been less consistent. For example, two studies found that secure and resistant preschoolers were more likely to comfort a distressed peer than insecure-avoidant children (Kestenbaum, Farber, & Sroufe, 1989; Sroufe, 1983). However, this result was not replicated in another study that just examined the differences

between secure and insecure children (Mitchell-Copeland, Denham, & DeMulder, 1997) illustrating the importance of considering insecure subtypes separately. It may also be the case that the quality of attachment has indirect effects on children's subsequent prosocial behavior and peer relationships by promoting more positive social cognition about social partners (e.g., positive attributions) (McElwain, Booth-LaForce, Lansford, Wu, & Dyer, 2008). The results of one meta-analysis suggested that the effects of attachment on peer relations may be stronger for older children than younger children because the internal working model is more stable as children age (Schneider, Atkinson, & Tardif, 2001). However, in a more recent meta-analysis of 44 studies including a broad age range of children, a secure attachment to parents was positively associated with better peer relations and the magnitude of this effect was in the small to moderate range and did not vary based on child age (Pallini, Baiocco, Schneider, Madigan, & Atkinson, 2014).

Generally, more research has been conducted on the association between an infant's attachment to mother and child outcomes than on their attachment to father. Independently, a secure attachment to father is associated with higher use of parent-oriented regulation (Diener et al., 2002). Moreover, the studies that have focused on both mother and father attachment relationships tend to find that a secure attachment with one caregiver can offset the negative effects of an insecure attachment with the other (Kochanska et al., 2005; Lickenbrock et al., 2013). Although the reviewed studies clearly suggest that one important mechanism by which parental sensitivity influences children's emotional development is through the development of attachment-related internal working models, other mechanisms may also explain such associations. In the next section, we elaborate on the potentially unique mechanisms, distinct from attachment, by which sensitivity to infant distress cues and sensitivity to infant nondistress cues may be related to children's emotional development (Leerkes, Blankson, & O'Brien, 2009).

Parental Sensitivity and Children's Emotional Development

Sensitivity to Infant Distress and Emotional Development When parents respond sensitively to infant distress cues by fostering attention shifting, offering security objects, mirroring infant affect, providing physical comfort, or modeling and supporting problem-solving strategies, they help infants learn to self-regulate. Such behaviors are associated with concurrent reductions in infants' expressed distress (Crockenberg & Leerkes, 2004; Jahromi & Stifter, 2007) and both reduced physiological stress reactivity and enhanced physiological regulation (Feldman, Singer, & Zagoory, 2010; Moore & Calkins, 2004). This experience of stress reduction should reinforce infants' future independent and parent-oriented efforts to regulate and may enhance infants' feelings of self-efficacy for self-regulation (Bell & Ainsworth, 1972). Such exchanges also teach infants that expressing and sharing negative emotions is acceptable and beneficial (Stern, 1985). In contrast, insensitive responses to distress can contribute to heightened distress in the moment, negative social cognitions, and maladaptive patterns of emotion regulation characterized by hypo- or hyper-regulation (Calkins, 1994).

Consistent with this view, sensitive maternal behavior observed during distressing tasks has been associated with infants' better vagal regulation (Moore & Calkins, 2004), observed emotion regulation behaviors (Crockenberg & Leerkes, 2004), and fewer subsequent internalizing (Crockenberg & Leerkes, 2006) and externalizing behavior problems (Crockenberg, Leerkes, & Barrig Jó, 2008). Likewise, maternal nighttime responsiveness to infant distress predicted infants' lower cortisol levels at bedtime and upon awakening, whereas maternal responsiveness when infants were nondistressed (i.e., sleeping) had the opposite effect (Philbrook & Teti, 2016). Thus, maternal sensitivity to distress, at least at night, may also promote adaptive HPA functioning. Moreover, sensitivity to infant distress cues

when infants were 6 months old was associated with children's subsequent (24 and 36 months) heightened social competence and reduced behavior problems for the sample as a whole and with reduced affect dysregulation for temperamentally reactive infants (Leerkes et al., 2009). These associations between maternal sensitivity to infant distress cues and adaptive emotion-related outcomes were independent of maternal sensitivity to nondistress cues, and maternal sensitivity to nondistress cues did not predict these outcomes independent of sensitivity to distress cues. The results of this study provide strong evidence that how parents respond when their infants are distressed is a highly salient predictor of subsequent emotional well-being, perhaps because infants learn the most about adaptive regulation in moments of distress. To date, the long-term effects of early sensitivity to distress on emotional outcomes in later childhood and adolescence have not been addressed. Furthermore, the bulk of research on parental sensitivity has focused on sensitivity during play, teaching, and caregiving tasks and indicates that sensitivity in these contexts is also adaptive as described below.

Sensitivity to Nondistress and Emotional Development Parents who respond sensitively to their children's positive and neutral affect likely elicit and reinforce positive emotions which may in turn promote resilience and psychological well-being (Conway, Tugade, Catalino, & Fredrickson, 2013). Drawing from this broaden and build perspective, it may be that young children's capacity to learn to self-regulate or to apply regulatory behaviors when needed is enhanced when in more frequent positive states. It is also possible that sensitivity during nonstressful interactions may have a positive effect on reactivity and regulation by promoting the development of infant attentional control which has important implications for infants' later ability to self-regulate (Perry, Swingler, Calkins, & Bell, 2016; Swingler, Perry, Calkins, & Bell, 2017). Furthermore, from a biological perspective, typical parent-child interactions that are sensitive in nature may promote infant homeostasis (Porges & Furman, 2011) and normative HPA activity (as opposed to hypo- or hyper-reactivity; Koss & Gunnar, 2017) both of which may position young children for more adaptive stress reactivity and regulatory responding.

Consistent with these perspectives, sensitive interactions during play, nonstressful exchanges, and typical routines are associated with children's use of more effective emotion regulation behaviors and more adaptive vagal regulation over time in diverse samples (Bocknek, Brophy-Herb, & Banerjee, 2009; Calkins & Johnson, 1998; Calkins, Smith, Gill, & Johnson, 1998; Eiden, Edwards, & Leonard, 2007; Perry, Calkins, & Bell, 2016) and with earlier onset of the typical diurnal cortisol pattern and lower cortisol secretions overall, indicating adaptive HPA functioning (Philbrook, Hinnant, Elmore-Staton, Buckhalt, & El-Sheikh, 2017). Finally, extensive prior evidence indicates also that sensitive caregiving in benign situations in infancy and toddlerhood is associated both with children's fewer behavior problem and higher social competence over time (e.g., Mills-Koonce, Willoughby, Garrett-Peters, Wagner, & Vernon-Feagans, 2016; NICHD ECCRN, 1998; Shaw, Owens, Giovannelli, & Winslow, 2001; Wagner, Propper, Gueron-Sela, & Mills-Koonce, 2016). As was the case for sensitivity to distress, there is evidence to suggest that infants and toddlers who are highly reactive or demonstrate early regulatory deficits are particularly dependent on parents' assistance to help them learn to regulate appropriately such that they both benefit most from sensitive caregiving and demonstrate the most maladaptive emotional outcomes over time, such as disruptive behavior and callous-unemotional behavior, when faced with early insensitive caregiving (e.g., Bradley & Corwyn, 2008; Degnan, Calkins, Keane, & Hill-Soderlund, 2008; Wagner, Mills-Koonce, Willoughby, & Cox, 2017).

There is also interest in the long-term effects of sensitivity during infancy on later adjustment independent of and in conjunction with sensitivity in later childhood and adolescence. Notably, the effects of early parental sensitivity/warmth on such outcomes in adolescence are apparent even

after controlling for a number of more proximal experiences (Eiden et al., 2016; Fraley et al., 2013), illustrating the lasting direct impact of early caregiving experiences on children's long-term emotional adjustment. These longitudinal direct effects are consistent with the enduring effects model whereby early parenting continues to exert a relatively comparable effect on child outcomes over time (Fraley et al., 2013). Yet, other studies that consider cross-lagged effects of parental sensitivity and children's emotional outcomes (e.g., social skills, antisocial behavior, internalizing, externalizing) or test mediational pathways from early childhood through middle childhood and adolescence demonstrate that the long-term effect of early sensitivity on later emotional adjustment is primarily indirect via children's acquisition of early emotional competencies that become relatively stable and are carried forward over time (Buck, 2014; NICHD ECCRN, 2003; Zvara, Sheppard, & Cox, 2018). For example, low paternal sensitivity in early childhood predicted boys' elevated externalizing in adolescence indirectly through their elevated externalizing in middle childhood (Zvara et al., 2018). These indirect effects are consistent with the revisionist model of early parenting effects (Fraley et al., 2013).

Beyond parenting in infancy, parental sensitivity in later childhood and adolescence also plays an important role for children's emotional adjustment in at least two ways. First, there is some evidence that maternal sensitivity in middle childhood and adolescence predicts adolescents' better social skills and lower impulsivity and risk-taking over and above early measures of sensitivity (Bradley & Corwyn, 2013; Burchinal, Lowe Vandell, & Belsky, 2014). Second, experiencing sensitive caregiving in later stages of childhood can compensate for early negative contextual experiences. For example, negative effects of long hours in early childcare on externalizing behaviors in adolescence were weaker among youth who experience sensitive caregiving in middle childhood and adolescence (Burchinal et al., 2014), and children who had insecure attachments to their mothers at 15 months had higher social competence and fewer behavior problems at age 3 if their mothers were high versus low on sensitivity at age 3 (Belsky & Fearon, 2002). An important caveat is that the majority of studies that have considered sensitivity over time in relation to children's emotional outcomes are drawn from the same dataset, the NICHD Study of Early Child Care and Youth Development, thus replication in other samples is warranted.

Paternal Sensitivity and Emotional Development The research cited above has primarily focused on maternal sensitivity, largely because mothers are more involved in the day-to-day care of infants and toddlers; thus, the role of paternal sensitivity in children's early emotional development remains somewhat less clear. Conceptually, there is little reason to believe that the mechanisms described above would operate differently for mothers versus fathers and some research supports this notion. For example, negative father behavior has been associated with higher cortisol reactivity to a stressor at 7 months and higher overall levels of cortisol at 2 years (Mills-Koonce et al., 2011), and father disengagement during playful interactions with their 3-month-old infants (an aspect of insensitivity) predicted heightened subsequent externalizing behavior (Ramchandani et al., 2013) similar to results for mothers. Likewise, there is little evidence that infants engage in different regulatory behaviors in stressful tasks with their mothers versus their fathers (Ekas, Lickenbrock, & Braungart-Rieker, 2013). On the other hand, some research suggests differential patterns linking maternal versus paternal sensitivity to relevant outcomes. For example, maternal sensitivity was associated with lower levels of infant negative affect during the Still Face Procedure, but father sensitivity was not (Braungart-Rieker, Garwood, Powers, & Notaro, 1998). Moreover, it has been argued that fathers' use of a more active, "rough-and-tumble" style could have unique implications for children's emotional development (Lamb & Lewis, 2010). And there is some evidence of complex gendered effects such that paternal sensitivity is particularly predictive of boys' externalizing behavior over time, whereas

maternal sensitivity is particularly predictive of girls' internalizing behavior over time (Zvara et al., 2018). Thus, there is clearly a need for additional studies in which mother and father sensitivity in stressful and nonstressful settings are examined as potential predictors of children's emotional outcomes over time. Next, we turn to the role of parental emotion socialization.

Parental Emotion Socialization and Children's Emotional Development

Emotion socialization refers to the process by which parents teach their children to understand their own and others' emotions and to appropriately express and control their own emotions (Eisenberg, Cumberland, & Spinrad, 1998). Key emotion socialization behaviors include the manner in which parents express, model, discuss, and react to emotions, including their children's emotions. Extensive prior evidence, reviewed elsewhere, indicates that parental emotion socialization practices have important implications for school-age children and adolescents' emotional development and well-being (Brand & Klimes-Dougan, 2010; Johnson, Hawes, Eisenberg, Kohlhoff, & Dudeney, 2017). Thus, we highlight the smaller set of studies in which emotion socialization was studied in the first few years of life organized by the type of emotion socialization behavior and briefly integrate a few studies of older children and adolescents.

Parental Emotion Expressiveness and Emotional Development Parents' own emotion expressiveness may influence children's emotional development in several ways. First, it serves as a model for the extent to which expressing different types of emotions is acceptable which may influence children's control of their own expressiveness. Second, it gives children the opportunity to learn about the causes and consequences of emotions via exposure. Third, parental emotions may elicit children's emotions. Moreover, given its aversiveness, chronic exposure to parental negative affect may contribute to persistent activation of infants' stress response systems and less effective regulation over time (Moore, 2009). Consistent with this view, evidence demonstrates that young children (infants through preschoolers) whose parents display high levels of positive affect express more positive emotions themselves, use more positive emotion language, and demonstrate greater emotion display rule knowledge (Halberstadt & Eaton, 2002; Nelson, Leerkes, O'Brien, Calkins, & Marcovitch, 2012; Wu, Wang, & Liu, 2017). In contrast, parents' self-reported negative expressiveness in the family was associated with their reports of their young children's higher negative emotionality and use of more maladaptive emotion regulation behaviors (Halberstadt & Eaton, 2002; Hu, Wang, & Liu, 2017; Nelson, Leerkes, et al., 2012, Nelson, O'Brien, et al., 2012). It would be ideal if multimethod measures of child emotional adaptation were employed in early childhood to reduce shared method variance and rule out the possibility that the observed associations between parental negative expressiveness and negative child outcomes are merely an artifact of a negative reporting bias among parents. Studies with older children and adolescents have focused on associations between parental affect directly observed during parent-child interaction minimizing this concern. Notably, observed parental negative affect is associated with children's maladaptive emotional outcomes such as lower emotion regulation and social competence and higher externalizing (Moed, Dix, Anderson, & Greene, 2017), higher depressive and anxiety symptoms (Schwartz et al., 2012), and biased (low) attention to sad faces (Connell, Patton, Klostermann, & Hughes-Scalise, 2013).

Parental Emotion Talk and Emotional Development The frequency and manner in which parents discuss emotions with toddlers and preschoolers also provide them with rich lessons about the meaning of emotions which may either enhance or undermine their knowledge of emotions and ability to discuss emotions, both of which are associated with better emotion regula-

tion and adaptive social behavior over time (Denham et al., 2015). For example, greater parental communication about emotions is associated with toddlers' empathy, concern, and efforts to help others, as well as more positive sibling interactions (Dunn & Munn, 1986; Garner, 2003; Zahn-Waxler, Radke-Yarrow, & King, 1979). Moreover, toddlers whose parents encouraged them to label and explain emotions were observed to engage in more prosocial behavior (helping and sharing) (Brownell, Svetlova, Anderson, Nichols, & Drummond, 2013). Notably, among toddlers with elevated behavior problems from economically disadvantaged families, high levels of maternal emotion talk were associated with reduced behavior problems a year later, and this effect was over and above maternal warmth (Brophy-Herb et al., 2015). However, engaging in high amounts of negative emotion talk may be counterproductive in some contexts. For example, children whose mothers emphasized messages about fear, threat, and an inability to handle negative emotions during a book-reading task in preschool had elevated social anxiety symptoms after their first year of school (Murray et al., 2014). Thus, talking to young children about emotions in a positive/nonthreatening manner and encouraging *them* to talk about emotions is linked with more adaptive emotion-related behavior among young children. Although not studied extensively among older children and adolescents, some research suggests that parental emotion talk may continue to exert a positive effect on emotional development. For example, parents' who tended to engage in explanatory discussion of emotions with their 8–13-year-olds had children with fewer anxiety symptoms in a high-risk sample (Suveg et al., 2008).

Parental Responses to Children's Negative Emotions and Emotional Development Two types of parental responses to young children's own negative emotions have been considered frequently in the literature (Fabes, Poulin, Eisenberg, & Madden-Derdich, 2002). Supportive emotion socialization includes responding to young children's negative emotions by providing comfort, encouraging the child to express their feelings, and helping them solve the problem that led to their distress. Nonsupportive emotion socialization includes ignoring, dismissing, or punishing children for showing negative emotions. Supportive emotion socialization practices may (1) enhance children's emotion understanding and emotion regulation by providing direct information about emotions and their regulation, (2) help children regulate behaviorally and physiologically in the moment, and (3) model and reinforce children's independent regulatory behaviors. In contrast, nonsupportive emotion socialization practices may teach children to devalue emotions and suppress their expression. However, without direct assistance in learning to regulate, this may in fact contribute to children's maladaptive patterns of emotion regulation, including the underregulation of emotion characterized by emotion outbursts and poor physiological regulation or the overregulation emotion characterized by the internalization of emotion (Eisenberg et al., 1998). Consistent with this conceptualization, mothers' supportive emotion socialization with their toddlers, characterized by emotion expressiveness and coaching in one study (Brophy-Herb et al., 2011) and the use of both problem-focused behaviors and distraction techniques in another (Scrimgeour, Davis, & Buss, 2016), predicted children's better social-emotional competence/prosocial behavior. Likewise, a broad measure of mothers' supportive emotion socialization that included expressiveness, supportive behavior, and mental state language correlated positively with Head Start teachers' reports of toddlers' coping skills and direct observation of toddlers' delay of gratification (Brophy-Herb, Stansbury, Bocknek, & Horodynski, 2012). Moreover, toddlers whose parents participated in an intervention designed to enhance emotion coaching demonstrated a decrease in externalizing symptoms (Lauw, Havighurst, Wilson, Harley, & Northam, 2014). In contrast, parental nonsupportive emotion socialization is associated with toddlers' and preschoolers' heightened aggression and reduced social competence (Spinrad et al., 2007), use of

less effective regulatory behaviors (Spinrad, Stifter, Donelan-McCall, & Turner, 2004), and heightened internalizing, albeit only among boys who were also high on negative emotionality (Engle & McElwain, 2011).

Similar negative effects of nonsupportive emotion socialization are apparent among adolescents in relation to their emotional and behavioral problems (Klimes-Dougan et al., 2007). However, in a recent meta-analysis of 49 studies linking emotion socialization to children's (aged 1.5–18 years) conduct problems, the association between nonsupportive emotion socialization and elevated conduct problems was stronger for younger than older children perhaps because socialization agents other than parents begin to play a larger role as children age (Johnson et al., 2017). Alternatively, the effects of parental emotion socialization on older children's outcomes may in fact be indirect via other emotional skills as was the case with the revisionist model of maternal sensitivity. Consistent with this view, more supportive emotion socialization longitudinally predicted 10-year olds' adaptive friendship quality via enhanced emotion regulation (Blair et al., 2014), and a similar pattern was reported for 11-year-old boys in relation to reduced internalizing and externalizing and heightened social skills (Cunningham, Kliewer, & Garner, 2009). There is some evidence that supportive emotion socialization has stronger effects on the emotional outcomes of children who are more temperamentally reactive because they are especially dependent on their caregivers for assistance regulating their distress given it is more frequent and intense (Dunsmore, Booker, Ollendick, & Greene, 2016). Given evidence that parental emotion socialization varies over time (Stettler & Katz, 2014), additional longitudinal work is needed to best understand the relative impact of emotion socialization at various developmental stages and the possibility that early and later emotion socialization may interact to predict children's emotional outcomes as has been demonstrated for sensitivity.

The Role of Race and Culture in Emotion Socialization and Development It is important to note that research with parents of older children (preschool and beyond) demonstrates that parental socialization goals, the behaviors parents engage in to achieve socialization goals, and the impact of specific socialization behaviors vary as a function of race and culture (Cole & Tan, 2007). For example, within the United States, African-American parents of preschoolers, more so than European-American parents, believe young children are likely to experience negative consequences from others for expressing their emotions, believe it is less acceptable to express negative emotions, and engage in more punitive and minimizing responses when their children are upset (Nelson, Leerkes, et al., 2012, Nelson, O'Brien, et al., 2012). However, punitive and minimizing behavior was not consistently linked with negative outcomes among African-American children or adults (Leerkes, Supple, Su, & Cavanaugh, 2015; Nelson et al., 2013). These racial differences in emotion beliefs and socialization practices likely evolved in response to racism in an effort to protect children, and as such, may be adaptive within this context (Dunbar, Leerkes, Coard, Supple, & Calkins, 2017), in part because racial minority children may perceive these behaviors more positively than European-American children (Perry, Leerkes, Dunbar, & Cavanaugh, 2017). It may be these differences are apparent in infancy (see Halberstadt & Lozada, 2011), or it may be they do not emerge until children reach an age when self-regulated behavior is expected and when children themselves are old enough to identify and understand their own race and interpret their parents' behavior in light of group norms. Nevertheless, we would be remiss not to note that the term "nonsupportive" emotion socialization was based on research with primarily White families living in low-risk contexts. These "nonsupportive" behaviors may in fact be adaptive for some racial groups and may operate differently in high-risk environments. Next, we turn to the role of more egregiously negative parenting in relation to children's early emotional development.

Harsh and Abusive Parenting and Children's Emotional Development

More extreme parenting conditions warrant attention because of their prevalence in early childhood. In the United States, approximately half (or more) of toddlers have parents who report using corporal punishment and yelling to discipline them (Berlin et al., 2009). Furthermore, the rate of child maltreatment is highest and increasing among infants under the age of 1 year compared to all other age groups but still occurs at relatively high rates among early adolescents (7 out of every 1000) (Federal Interagency Forum on Child and Family Statistics, 2017). Harsh, intrusive, and overly controlling discipline and experiences of abuse/neglect may be associated with young children's maladaptive emotion-related outcomes as a function of several mechanisms. For example, young children reared in these conditions may (1) model negative parental affect and behavior; (2) engage in aversive behavior because it is reinforced via negative parental attention (Patterson, 2016); (3) struggle to control their emotions and related behavior because they have received limited external support to assist them in learning effective strategies to do so (Kim & Cicchetti, 2010); and/or (4) be chronically stressed leading the development of non-normative patterns of HPA activity which in turn undermines emotional and behavioral adaptation (Koss & Gunnar, 2017).

Consistent with the view that such experiences undermine children's emotional development, in a large (N = 2573) and diverse sample, using a cross-lagged design, maternal spanking at age 1 predicted children's aggressive behavior at age 2 (Berlin et al., 2009). Notably, parental race and warmth did not moderate this association. Likewise, in a small sample of African-American parents of toddlers, observed harsh parenting was associated with more total behavior problems as a main effect and with higher internalizing symptoms only in dangerous neighborhoods, undermining the argument that harsh parenting is protective in certain contexts (Callahan, Scaramella, Laird, & Sohr-Preston, 2011). More recently, the frequency with which fathers used corporal punishment with their toddlers predicted their children's externalizing behaviors a year later, and this was particularly true if their mothers also engaged in harsh parenting, suggesting that the impact of harsh parenting is additive across parents (Mendez, Durtschi, Neppl, & Stith, 2016). Moreover, a recent meta-analysis including over 160,000 parents and children across studies indicated that spanking is associated with a host of negative child outcomes including noncompliance, aggression, and internalizing symptoms (mean effect size = 0.33; Gershoff & Grogan-Kaylor, 2016). This meta-analysis included studies of a broad age range of children including 15 studies with children under the age of 2, and the negative effects of spanking on later emotion-related outcomes were not moderated by child age, indicating that the significant effects were apparent even when spanking occurred early in childhood. Importantly, this meta-analysis also concluded that the more children are spanked throughout childhood, regardless of the age in which the spanking occurred, the greater the risk was for physical abuse by a parent (Gershoff & Grogan-Kaylor, 2016).

Certainly, consistent evidence indicates that child abuse is associated with a host of maladaptive emotional outcomes including biased emotion perception, emotion regulation difficulties, emotion-related psychopathology, and compromised peer relations (Harms, Leitzke, and Pollak, Chap. 28, this volume; Gershoff & Grogan-Kaylor, 2016. Notably, early-onset maltreatment (prior to age 5) is a stronger predictor of internalizing and externalizing in elementary school-age children (Keiley, Howe, Dodge, Bates, & Pettit, 2001) and anxiety and depression among adults (Kaplow & Widom, 2007) than later-onset maltreatment. Thus, the experience of abuse in the first few years of life has a unique and lasting effect on children's subsequent emotional well-being. However, harsh and abusive parenting in middle childhood and adolescence are also significant predictors of antisocial and socially incompetent behavior (Bank & Burraston, 2001), poorer mental health including depression and anxiety (Bender et al., 2007),

and poorer quality social relationships later in the adolescent's life (Allen, Hauser, O'Connor, Bell, & Eickholt, 1996). Although these negative effects of harsh and abusive parenting have been documented in the literature, research has focused a great deal examining the resiliency factors associated with maltreatment in middle childhood and adolescence. These resiliency or protective factors can manifest in many ways, including individual differences, family factors, and extra-familial influences (Perkins & Jones, 2004). A positive school climate, the presence of healthy and high-quality relationships, and individual reactivity have all been found to serve as protective factors for adolescents when faced with harsh and abusive parenting (see Afifi & MacMillan, 2011 for a review). For example, children and adolescents who display lower levels of negative emotions, show lower levels of stress when exposed to adverse situations, and have an easier temperament have been found to be less impacted by neglect and abuse (Afifi & MacMillan, 2011). Next, we turn to the role of parents' own emotion-related characteristics in relation to children's early emotional development.

Parents' Emotion-Related Characteristics and Children's Emotional Development

Parents' emotion characteristics such as depression, anxiety, and emotion dysregulation may be related to their children's early emotional adjustment through multiple pathways, including genetic transmission, fetal programming, indirect effects via parenting, and direct effects via exposure. Given our focus on the effects of family context, we briefly summarize the latter three below.

Fetal Programming and Emotional Development Accumulating evidence indicates that stress and trauma experienced by the mother during pregnancy affect the developing fetus' intrauterine environment in a manner that has lasting consequences. As such, the prenatal family environment is a critical context that sets the stage for some aspect of young children's emotional development. Maternal depression, anxiety, interpersonal violence, and psychosocial stress during the prenatal period are linked with elevated maternal cortisol secretions, altered placental enzymes, and reduced maternal immunity, each of which may alter fetal HPA functioning and undermine subsequent child emotional and physical health via fetal programming (Beijers, Buitelaar, & de Weerth, 2014; Pearson, Tarabulsy, & Bussières, 2015). Consistent with this view, pregnant mothers' cortisol reactivity predicted poorer infant emotion regulation at 6 months (Bolten et al., 2013), and prenatal maternal depression has been linked to an increased risk for child emotional problems, including externalizing symptoms (O'Connor, Heron, Golding, Beveridge, & Glover, 2002), and increased likelihood of disorganized attachment (Hayes, Goodman, & Carlson, 2013). Likewise, prenatal but not postnatal interpartner violence predicted infants' higher cortisol reactivity and behavior problems at age 1 (Levendosky et al., 2016). This research illustrates the importance of prenatal family context for subsequent emotional development and the importance of controlling for prenatal factors in order to make strong inferences about the role of postnatal family context in young children's emotional development.

Indirect Effects of Parental Characteristics on Emotional Development Through Parenting The most frequently considered (nongenetic) pathway by which parental emotion characteristics may influence children's emotional development is via their impact on parenting behavior. For example, parental depression is consistently associated with less sensitive parenting (Field, 2010), parental anger is associated with harsh discipline (Lorber, Mitnick, & Slep, 2016), parental affect dysregulation is associated with less sensitive and harsher parenting (Lorber, 2012; Shaffer & Obradović, 2017), and parental psychopathology is associated with disorganized infant-parent attachment (Lyons-Ruth & Jacobvitz, 2016). And, as reviewed above, each

of these parenting behaviors/attachment relationships are associated with children's maladaptive emotional outcomes. Thus, parental emotional well-being has important implications for children's emotional development via its impact on parenting behavior. However, direct effects are also possible.

Direct Effects of Parent Characteristics on Emotional Development Parents' emotion-related characteristics may have direct effects on young children's emotional development via emotion contagion or physiological synchrony. To elaborate, if parents frequently express fear, sadness, or anger in their children's presence, it may cause their children to become upset via emotion contagion. Evidence that infants engage in social referencing during stressful or ambiguous situations (Hatfield, Cacioppo, & Rapson, 1994) and their emotional reactions in such situations vary systematically as a function of parental affect (Klinnert, Campos, Sorce, Emde, & Svejda, 1983) supports this view. Further, parental physiological dysregulation in moments of upset may contribute to infant's physiological dysregulation in the moment through the synchronization of biological systems when in close contact with one another (Feldman, 2007). Over time, both processes may contribute to physiological burnout undermining a young child's ability to regulate effectively (Moore, 2009). Consistent with this view, *postnatal* maternal and paternal depressive symptoms were linked with infant's atypical cortisol responses to a stressor independent of possible fetal programming effects (Laurent, Ablow, & Measelle, 2011; Laurent et al., 2013). Likewise, children of mothers with elevated depressive symptoms demonstrated compromised emotion understanding (Martin, Williamson, Kurtz-Nelson, & Boekamp, 2015), and in one study, this effect was independent of infant-mother attachment and parenting behavior (Raikes & Thompson, 2006). Likewise, maternal physiological dysregulation while parenting predicted infants' attachment disorganization and heightened behavior problems at 14 months independent of observed maternal sensitivity ruling out the possibility of untested indirect effects (Leerkes, Su, Calkins, O'Brien, & Supple, 2017). In sum, parental emotion-related characteristics are an important aspect of the family environment that influence children's early emotional adjustment via a variety of mechanisms. The extent to which these processes in early life affect long-term well-being is unclear. Likewise, the possibility that comparable effects occur in later parent-child interactions is primarily untested. On the one hand, given parents of older children spend less time in close, physical proximity to their children, biological synchrony may play less of a role over time. On the other hand, older children's greater capacity to read parental emotion signals may make them more susceptible to the negative effects of heightened parental arousal; but these effects may be confounded with the parental expression of negative affect. Next, we consider the impact of the broader family system on children's emotional development.

Emotional Development Within the Family System

Certainly, the parent-child relationship is the family relationship considered most frequently in relation to children's emotional adjustment and has profound effects on children's emotional well-being as described above. In this section, we describe the implications of three additional family relationships for young children's emotional development: the marital/partner, coparental, and sibling subsystems. According to family systems theory (Minuchin, 1985), each of these relationships, which are composed of varying family members, are subsystems within the broader family system. Each family members' characteristics can influence functioning within a subsystem and vice versa. Moreover, the nature and quality of one subsystem can influence other subsystems, and these associations are bidirectional. For example, marital strain can undermine parenting quality or vice versa. Importantly, a systems perspective recognizes that changes in structure (i.e., birth of a sibling, marital dissolu-

tion) and in function (i.e., periods of heightened stress) are inherent in family life and can affect each member of the family.

Interparental Conflict and Children's Emotional Development

The majority (72%) of young children between birth and age 5 live with two parents who are either married or cohabiting (Federal Interagency Forum on Child and Family Statistics, 2017); thus, the quality of the couple relationship may have significant implications for most young children. Of the many dimensions that characterize the quality of adult romantic relationships (e.g., adjustment, intimacy, satisfaction, violence), conflict has been considered most frequently in relation to children's and adolescent's concurrent and long-term adjustment because it is believed to have particularly salient effects on their emotional well-being. For example, marital conflict is associated with children's and adolescents' elevated emotional reactivity and behavior problems, maladaptive emotion regulation, and altered cortisol reactivity, (e.g., Cummings, El-Sheikh, Kouros, & Buckhalt, 2009; Lucas-Thompson, Lunkenheimer, & Dumitrache, 2017). Research in this area has been guided by two major perspectives about how partner conflict may undermine child well-being (Grych & Fincham, 2001). First, stress in the couple relationship may spill-over into the parent-child subsystem and contribute to compromised parenting quality, which in turn undermines child well-being. Second, witnessing parental conflict may directly undermine child well-being by making children feel insecure, emotionally distressed, at fault, or responsible for fixing the problem (Cummings & Davies, 2010). These emotional responses and accompanying physiological changes may undermine children's long-term adaptation. Only recently, however, has attention to the role of conflict exposure in the earliest years of life become common. This attention is warranted given approximately 37% of young children are exposed to verbal or physical interparental conflict (Westrupp, Rose, Nicholson, & Brown, 2015), and infants are more likely to be exposed to interparental conflict and violence than older children (Fantuzzo, Boruch, Beriama, & Atkins, 1997). In the following sections, we summarize evidence linking marital conflict to emotion regulation and then behavior problems among young children.

Interparental Conflict and Emotional Reactivity and Regulation Research indicates that interparental conflict and relationship dissatisfaction predict atypical emotion expression and compromised emotion regulation at the behavioral level. For example, 6- to 14-month-old infants paid more attention to and displayed more negative emotions and less adaptive behaviors such as play during destructive and depressive interparental conflict discussion than constructive conflict discussion (Du Rocher Schudlich, White, Fleischhauer, & Fitzgerald, 2011). These findings indicate infants perceive and are affected by the conflict in the moment. Additionally, parent-reported marital conflict is associated with less adaptive emotion regulation behaviors among infants (Crockenberg, Leerkes, & Lekka, 2007; Frankel, Umemura, Jacobvitz, & Hazen, 2015; Porter, Wouden-Miller, Silva, & Porter, 2003), particularly if they are temperamentally reactive (Parade & Leerkes, 2011). Thus, interparental conflict undermines infant self-regulation in other distressing contexts perhaps because caregivers in such relationships provide less external assistance with regulation. Notably, in two of these studies, the association between conflict and infants' less adaptive emotion regulation was greater among infants with higher exposure to interparental conflict suggesting sensitization (Crockenberg et al., 2007; Du Rocher Schudlich et al., 2011). Likewise, only infants who had a history of exposure to interparental violence demonstrated heightened distress in a laboratory play observation following exposure to a simulated angry phone call (DeJonghe, Bogat, Levendosky, Von Eye, & Davidson, 2005). Moreover, recent evidence suggests that temperamentally reactive infants may be particularly sensitive to conflict in their environment (Mammen, Busuito, Moore, Quigley, & Doheny, 2017). In a

similar vein, adolescents who were better at regulating their emotions were less hostile and more positive, even in situations of high parental hostility (Schulz, Waldinger, Hauser, & Allen, 2005) suggesting that both reactivity and regulation may moderate the impact of marital conflict on child outcomes throughout childhood and adolescents.

Conflict in the couple relationship is associated also with physiological indices of infants' and toddlers' stress reactivity and regulation. For example, interparental violence and aggression are associated with higher basal cortisol (Davies, Sturge-Apple, Cicchetti, Manning, & Zale, 2009). Interparental conflict is also linked with toddler cortisol reactivity during marital conflict (Sturge-Apple, Davies, Cicchetti, & Manning, 2012), and in other stressful contexts if other risk factors such as early insensitive maternal behavior are present (Hibel, Granger, Blair, Cox, & The Family Life Project Key Investigators, 2011). Additionally, longitudinal associations between interparental aggression and toddler cortisol reactivity vary as a function of child temperament such that toddlers with an inhibited temperament demonstrated increased cortisol reactivity to the conflict simulation but toddlers with a bold temperament demonstrated decreased cortisol reactivity to conflict over time (Davies, Sturge-Apple, & Cicchetti, 2011). These results indicate the impact of interparental conflict on infants' cortisol reactivity is complex and point to the need for additional research in this area. Nevertheless, the results support the notion that exposure to interparental conflict contributes to nonnormative patterns of HPA activity and reactivity. A similar pattern is apparent for children's autonomic system responding.

Among young infants, interparental conflict has typically been associated with lower concurrent basal vagal tone (Moore, 2010; Porter & Dyer, 2017; Porter et al., 2003), albeit only among males in one study (Graham, Ablow, & Measelle, 2010). However, among toddlers, interparental aggression was associated with higher basal vagal tone (Davies et al., 2009). In regard to vagal withdrawal when exposed to a stressor, interparental conflict was directly linked with lower vagal withdrawal and recovery across episodes of the Still Face Procedure at 6 months in one study (Moore, 2010) and indirectly associated with less recovery during the reunion episode of the Still Face via less dyadic flexibility offering some support for the spillover hypothesis in another study (Busuito & Moore, 2017). In contrast, a positive interparental relationship characterized by dyadic adjustment was associated with greater vagal withdrawal among boys when presented a novel toy (Graham et al., 2010). As a set these results suggest that the impact of interparental conflict on parasympathetic nervous system activity may be dependent on infant gender and age.

Interparental Conflict and Behavior Problems Interparental conflict during infancy is also a risk factor for children's subsequent emotion-related behavior problems. That is, interparental conflict is consistently associated with caregivers' reports of children's later internalizing and behavioral inhibition (Pauli-Pott & Beckmann, 2007; Zhou, Cao, & Leerkes, 2017), externalizing (DeJonghe, von Eye, Bogat, & Levendosky, 2011; Stover et al., 2012; Zhou et al., 2017), total behavior problems (Graham, Kim, & Fisher, 2012), and trauma symptoms (Bogat, DeJonghe, Levendosky, Davidson, & von Eye, 2006). The spillover hypothesis via parenting was directly tested in three of these studies and was primarily supported such that associations between interparental conflict and behavior problems were indirect via reduced sensitivity to distress cues (internalizing symptoms only; Zhou et al., 2017) or increased use of harsh/hostile parenting (Graham et al., 2012; Stover et al., 2012). However, the association between interparental conflict and pure externalizing symptoms was direct in one study (Zhou et al., 2017). Notably, the study by Stover et al. (2012) utilized an adoption sample suggesting that the negative impact of marital difficulties on young children's adaptation is not accounted for by some shared underlying genetic trait, and the study by Zhou et al. (2017) controlled for prenatal interparental conflict ruling out fetal programming. Finally, toddler

negative emotionality has also been identified as a moderator of the association between marital conflict and behavior problems such that problems are highest among temperamentally reactive infants exposed to high levels of conflict (Hentges, Davies, & Cicchetti, 2015). Notably, the manner in which marital conflict impacts children appears to vary as a function of children's age such that conflict is more strongly associated with externalizing behaviors in early childhood and internalizing symptoms in later childhood and adolescence (Zimet & Jacob, 2001).

Although the research findings in this area are quite nuanced suggesting important moderating and mediating factors, sufficient evidence has accrued to form some general conclusions. First, infants are aware of, attend to, and have negative behavioral and emotional reactions during interparental conflict. Second, exposure to conflict is associated with young children's maladaptive emotional, behavioral, and physiological outcomes either directly or indirectly via compromised parenting, and such effects may be stronger among temperamentally reactive infants and children and vary across developmental age. Such findings have important implications for parental education in that they suggest it is important to shield infants and children from conflict exposure, particularly if they are temperamentally reactive to begin with, even though they may not have the capacity to understand the content. Interventions in families with older children can also be encouraged to reduce child exposure to marital conflict but can also be taught specific strategies to talk with their children after a conflict has occurred, which has been found to reduce the negative effects of marital conflict on children (Cummings, Davies, & Campbell, 2000). Additionally, parents in conflictual relationships may warrant intervention aimed at both reducing marital conflict and enhancing parenting quality. Finally, children in families with high levels of conflict may benefit from direct intervention aimed at promoting emotional well-being. In this vein, interventions designed to enhance coparenting, the family system we turn to next, have yielded positive results for the quality of the couple relationship, parenting, and child well-being (Feinberg et al., 2016).

Coparenting and Children's Emotional Development

Coparenting reflects how parents coordinate their efforts and support one another to parent their child(ren) (Feinberg, 2003; McHale, 1995). High coparenting quality is characterized by agreement about how to parent, fairly shared parental responsibilities, and cooperation and support (as opposed to competition, conflict, undermining) when interacting with children. Although couple relationship functioning and coparenting quality are correlated with one another, they are distinct constructs in that coparenting is focused exclusively on rearing children, whereas the couple relationship encompasses many other domains (e.g., intimacy, division of household chores). Given young children have daily exposure to interactions that simultaneously involve both parents, it is not surprising that coparenting quality is related to children's emotional development in addition to the quality of dyadic parent-child interactions. For example, adaptive coparenting is associated with positive outcomes, such as fewer behavior problems, higher social competence, and secure attachment to fathers over and above the quality of dyadic parenting or other family characteristics among infants (e.g., Brown, Schoppe-Sullivan, Mangelsdorf, & Neff, 2010), preschoolers (Cabrera, Scott, Fagan, Steward-Streng, & Chien, 2012), school-age children (Murphy, Jacobvitz, & Hazen, 2016), and adolescents (Feinberg, Kan, & Hetherington, 2007). Such effects may occur via mechanisms similar to those described above. That is, smooth coparental interactions may enhance children's feelings of security as opposed to threat (e.g., Martin, Sturge-Apple, Davies, Romero, & Buckholz, 2017) and may serve as models of prosocial/well-regulated behavior. It is also possible that coparenting quality predicts children's more adaptive emotional development indirectly by supporting higher individual parenting involvement and quality (Kwon, Jeon, & Elicker,

2013), particularly among nonresidential, never-married, or teen fathers (Fagan & Lee, 2011; Fagan & Palkovitz, 2011; Waller, 2012), whose children are often at risk for maladaptive emotional adjustment. Notably, according to a meta-analysis, the positive effects of adaptive coparenting are larger for children who are younger, males, or from at-risk families (Teubert & Pinquart, 2010). Given the diversity in family formations and their transitions over time, it is important to note that adaptive coparenting post-divorce (Lamela, Figueiredo, Bastos, & Feinberg, 2016) and support from nonparental coparents (e.g., grandmothers, aunts, friends; Parent, Jones, Forehand, Cuellar, & Shoulberg, 2013) predict children's emotional well-being. As a set, the reviewed studies underscore the importance of considering the role of coparenting, in addition to parenting, in relation to children's emotional development.

Sibling Relationships and Children's Emotional Development

The majority of US children experience the birth of a sibling, most typically between 2 and 3 years of age, leading to shifts in family roles and relationships that may affect emotional development (Volling, 2012). For example, fathers may become more involved in the care of older siblings and mothers' interactions with older siblings may become more focused on discipline than play. On the one hand, such changes could undermine the older sibling's emotional development because they perceive these changes as threatening. On the other hand, compelling arguments suggest that children may learn important lessons about the meaning of emotions and how to regulate them in the context of normative sibling conflicts and positive sibling interactions (Kramer, 2014). In fact, the evidence is mixed across studies (Volling, 2012), likely because the impact of having a sibling on emotional development depends on the nature of existing family relationships, the quality of the emerging sibling relationship, and child characteristics. For example, children who were between the ages of 1 and 5 when their sibling was born were more likely to display increasing externalizing symptoms following their siblings birth if they had an insecure attachment with their mother, and they were more likely to display high/increasing internalizing symptoms if they were high on negative emotionality or if their parents had a negative partner relationship (Volling et al., 2017). Likewise, sibling relationships characterized by aggression and rivalries are associated with early behavior problems (Tucker, Finkelhor, Turner, & Shattuck, 2013), particularly so for younger siblings who are high on temperamental negative emotionality (Morgan, Shaw, & Olino, 2012), or in the context of a negative coparental relationship (Song & Volling, 2015). Thus, sibling relationships are an important feature of the family context that have implications for young children's early emotional development.

As children age, the quality of their sibling relationships continues to predict emotional adjustment independent of the quality of parent-child relationships. For example, increased sibling negativity is associated with elevated depressive symptoms and risky behaviors (Whiteman, Solmeyer, & McHale, 2015), whereas sibling support is associated with lower externalizing symptoms (Branje, van Lieshout, van Aken, & Haselager, 2004) in sibling pairs spanning age 10–15. Notably, one study demonstrated that the longitudinal association between sibling affection and both heightened prosocial behavior and reduced externalizing was mediated in part by a broad measure of self-regulation which included emotional regulation (Padilla-Walker, Harper, & Jensen, 2010). Additionally, affectionate sibling relationships reduced the association between stressful life events and heightened internalizing symptoms among adolescents (Gass, Jenkins, & Dunn, 2007). Thus, positive sibling relations can operate as both a promotive factor and protective factor in relation to children's emotional development from infancy through adolescence over and above the quality of parent-child relations.

In sum, the presence and nature of family relationships beyond the parent-child dyad have important implications for young children's emotional development and well-being. The nature of each family subsystem has the potential to impact each family member and every other family subsystem, and the entire family is situated within the same broader context (e.g., economic strain). As such, it is important to acknowledge that risks may accrue within and across family systems and may have additive or cascading effects on children's emotional development. To illustrate, high sibling conflict may stress parents' already depleted resources, undermining marital, coparenting, and parenting dynamics leading to escalating child emotion dysregulation and behavior problems over time. Yet, on the other hand, strengths in one system may be used to offset difficulties in others, and families may be particularly open to such efforts at key transitions in family life such as the birth of a new child.

Remaining Gaps and Future Research Directions

The research in this area is extensive and offers consistent support for the view that the early family context plays an important role in children's early emotional development. However, the field could benefit from greater precision to identify mechanisms, greater focus on fathers and family systems in addition to the focus on mothering, and greater attention to the role of child effects. To elaborate on the first, most of the predictor variables considered in this chapter are interrelated rather than independent. For example, sensitivity is associated with attachment (Ainsworth et al., 1978), emotion socialization (Spinrad et al., 2007), and both marital and coparenting quality (Brown et al., 2010; Zhou et al., 2017). Yet, many studies focus on only one of these constructs making it difficult to pinpoint the actual mechanism explaining observed associations. For example, additional work is warranted to discern if attachment does in fact fully mediate associations between sensitivity and emotional development or if the other proposed mechanisms (e.g., learning) also play a role over and above attachment. Additionally, it is unclear which parenting behaviors or family factors have unique or stronger effects on children's emotional development, and if this varies as children mature. Perhaps parental sensitivity is the key infancy predictor of later emotional development because children are so dependent on external regulation at that stage, but as children become toddlers and expectations for self-regulation emerge, emotion socialization may emerge as a stronger predictor. Likewise, whether marital and coparenting quality have direct effects on emotional development or primarily operate via spillover to compromise parenting may vary with child age or depending on the outcome (Zhou et al., 2017), both of which warrant additional consideration. Given the focus on marital conflict in infancy is relatively recent, information on the longitudinal effects or relative impact of early versus later exposure to conflict is somewhat unclear. Such knowledge would be useful both to refine theories of emotional development but also for intervention purposes by identifying the most salient aspects of parenting/family context to target.

Second, given the heterogeneity in family structure, there is a need for more studies that include both coparents, whether that be a mother and father, homosexual parents, a parent and grandparent, and so forth (e.g., Parent et al., 2013). In such research, it is important to consider the amount of each parent figures' involvement in different aspects of parenting and the quality of the child's attachment to each parental figure, so we can better understand independent and various joint effects of multiple caregivers on young children's emotional development. Competing models of joint effects exist such as the additive model in which children are expected to have the best outcomes when they encounter adaptive parenting from both parents, the compensatory/buffering model in which adaptive par-

enting by one parent may compensate for maladaptive parenting by the other, and diverging/complementary models in which children may benefit from a mix or parenting quality because it enriches the variety of lessons they learn about emotions (McElwain, Halberstadt, & Volling, 2007). There is also the possibility that one parental figure has a stronger effect on a child's emotional development than the other based on parent and child gender, primary caregiver status, or the quality of the relationship (Umemura, Jacobvitz, Messina, & Hazen, 2013). Relatively few studies, to date, address these questions.

Finally, throughout the chapter, we integrated child factors that moderate the relations between family factors and emotional development with a primary focus on children's negative emotional reactivity, gender, and age as these characteristics are considered most frequently. It is also important to consider other temperamental characteristics including positive emotionality/effortful control as these are distinct from negative emotionality and may also modify the nature of associations between family factors and emotional development (Reuben et al., 2016). Moreover, children play an active role in eliciting individual differences in caregiving, marital functioning, and coparenting quality, as a function of temperament. Thus, additional research considering transactional effects between the family context, child characteristics, and emotional development over time is warranted (e.g., Perry, Mackler, Calkins, & Keane, 2014). Ultimately, it is important to remember that children with more negative emotional traits often elicit more negative parenting over time, contribute to stress in familial relationships, and are more susceptible to negative effects of negative parenting and family relationships on emotional adjustment. As such, families of such children are in particular need of support, and there is a need to identify child and familial factors that operate as buffers. It is important that such efforts occur in families that are diverse with respect to race and ethnicity, socioeconomic status, and family structure.

Conclusion

As emphasized throughout this volume, important advancements in emotional development occur in childhood including learning to understand and self-regulate increasingly differentiated and complex emotions in a manner that facilitates behavior that is consistent with age-appropriate social norms. Children are highly dependent on their caregivers to learn theses skills, and over time, they internalize lessons learned about emotions within the family and carry them forward into other social relationships and contexts. The research cited in this chapter illustrates that individual difference in these skills is influenced, in part, by the quality of parent-child and other family relationships, specific features of parenting, and parents' own emotional characteristics. As such, the family context is of central import in the study of emotional development.

References

Achenbach, T. M., Edelbrock, C., & Howell, C. T. (1987). Empirically based assessment of the behavioral/emotional problems of 2- and 3-year-old children. *Journal of Abnormal Child Psychology, 15*, 629–650. https://doi.org/10.1007/BF00917246

Afifi, T. O., & MacMillan, H. L. (2011). Resilience following child maltreatment: A review of protective factors. *The Canadian Journal of Psychiatry/La Revue Canadienne de Psychiatrie, 56*, 266–272.

Ahnert, L., Gunnar, M. R., Lamb, M. E., & Barthel, M. (2004). Transition to child care: Associations with infant-mother attachment, infant negative emotion, and cortisol elevations. *Child Development, 75*, 639–650. https://doi.org/10.1111/j.1467-8624.2004.00698.x

Ainsworth, M. S., Blehar, M. C., Waters, E., & Wall, S. (1978). *Patterns of attachment: A psychological study of the strange situation*. Oxford, UK: Lawrence Erlbaum.

Allen, J. P. (2008). The attachment system in adolescence. In J. Cassidy, P. R. Shaver, J. Cassidy, & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (pp. 419–435). New York, NY: Guilford Press.

Allen, J. P., Hauser, S. T., O'Connor, T. G., Bell, K. L., & Eickholt, C. (1996). The connection of observed hostile family conflict to adolescents' developing

autonomy and relatedness with parents. *Development and Psychopathology, 8*, 425–442. https://doi.org/10.1017/S0954579400007173

Bank, L., & Burraston, B. (2001). Abusive home environments as predictors of poor adjustment during adolescence and early adulthood. *Journal of Community Psychology, 29*, 195–217. https://doi.org/10.1002/jcop.1014

Bar-Haim, Y., Dan, O., Eshel, Y., & Sagi-Schwartz, A. (2007). Predicting children's anxiety from early attachment relationships. *Journal of Anxiety Disorders, 21*, 1061–1068. https://doi.org/10.1016/j.janxdis.2006.10.013

Beijers, R., Buitelaar, J. K., & de Weerth, C. (2014). Mechanisms underlying the effects of prenatal psychosocial stress on child outcomes: Beyond the HPA axis. *European Child & Adolescent Psychiatry, 23*, 943–956. https://doi.org/10.1007/s00787-014-0566-3

Beijers, R., Riksen-Walraven, M., Sebesta, K., & de Weerth, C. (2017). Differential associations between behavioral and cortisol responses to a stressor in securely versus insecurely attached infants. *Behavioural Brain Research, 325*, 147–155. https://doi.org/10.1016/j.bbr.2016.10.008

Bell, S. M., & Ainsworth, M. D. (1972). Infant crying and maternal responsiveness. *Child Development, 43*, 1171–1190. https://doi.org/10.2307/1127506

Belsky, J., & Fearon, R. P. (2002). Early attachment security, subsequent maternal sensitivity, and later child development: Does continuity in development depend upon continuity of caregiving? *Attachment & Human Development, 4*, 361–387. https://doi.org/10.1080/14616730210167267

Bender, H. L., Allen, J. P., McElhaney, K. B., Antonishak, J., Moore, C. M., Kelly, H. O., & Davis, S. M. (2007). Use of harsh physical discipline and developmental outcomes in adolescence. *Development and Psychopathology, 19*, 227–242. https://doi.org/10.1017/S0954579407070125

Berlin, L. J., Ispa, J. M., Fine, M. A., Malone, P. S., Brooks-Gunn, J., Brady-Smith, C., … Bai, Y. (2009). Correlates and consequences of spanking and verbal punishment for low-income White, African American, and Mexican American toddlers. *Child Development, 80*, 1403–1420. https://doi.org/10.1111/j.1467-8624.2009.01341.x

Bernard, K., & Dozier, M. (2010). Examining infants' cortisol responses to laboratory tasks among children varying in attachment disorganization: Stress reactivity or return to baseline? *Developmental Psychology, 46*, 1771–1778. https://doi.org/10.1037/a0020660

Bernard, K., Dozier, M., Bick, J., & Gordon, M. K. (2015). Intervening to enhance cortisol regulation among children at risk for neglect: Results of a randomized clinical trial. *Development and Psychopathology, 27*, 829–841. https://doi.org/10.1017/S095457941400073X

Blair, B. L., Perry, N. B., O'Brien, M., Calkins, S. D., Keane, S. P., & Shanahan, L. (2014). The indirect effects of maternal emotion socialization on friendship quality in middle childhood. *Developmental Psychology, 50*, 566–576. https://doi.org/10.1037/a0033532

Blair, C., Granger, D. A., Kivlighan, K. T., Mills-Koonce, R., Willoughby, M., Greenberg, M. T., … Fortunato, C. K. (2008). Maternal and child contributions to cortisol response to emotional arousal in young children from low-income, rural communities. *Developmental Psychology, 44*, 1095–1109. https://doi.org/10.1037/0012-1649.44.4.1095

Blandon, A. Y., Calkins, S. D., Keane, S. P., & O'Brien, M. (2010). Contributions of child's physiology and maternal behavior to children's trajectories of temperamental reactivity. *Developmental Psychology, 46*, 1089–1102. https://doi.org/10.1037/a0020678

Bocknek, E. L., Brophy-Herb, H. E., & Banerjee, M. (2009). Effects of parental supportiveness on toddlers' emotion regulation over the first three years of life in a low-income African American sample. *Infant Mental Health Journal, 30*, 452–476. https://doi.org/10.1002/imhj.20224

Bogat, G. A., DeJonghe, E., Levendosky, A. A., Davidson, W. S., & von Eye, A. (2006). Trauma symptoms among infants exposed to intimate partner violence. *Child Abuse & Neglect, 30*, 109–125. https://doi.org/10.1016/j.chiabu.2005.09.002

Bolten, M., Nast, I., Skrundz, M., Stadler, C., Hellhammer, D. H., & Meinlschmidt, G. (2013). Prenatal programming of emotion regulation: Neonatal reactivity as a differential susceptibility factor moderating the outcome of prenatal cortisol levels. *Journal of Psychosomatic Research, 75*, 351–357. https://doi.org/10.1016/j.jpsychores.2013.04.014

Bowlby, J. (1969). *Attachment and loss: Attachment*. New York, NY: Basic Books.

Bowlby, J. (1973). *Attachment and loss: Separation*. New York, NY: Basic Books.

Bowlby, J. (1980). *Attachment and loss: Loss*. New York, NY: Basic Books.

Bradley, R. H., & Corwyn, R. F. (2008). Infant temperament, parenting, and externalizing behavior in first grade: A test of the differential susceptibility hypothesis. *Journal of Child Psychology and Psychiatry, 49*, 124–131.

Bradley, R. H., & Corwyn, R. (2013). From parent to child to parent…: Paths in and out of problem behavior. *Journal of Abnormal Child Psychology, 41*, 515–529. https://doi-org.libproxy.uncg.edu/10.1007/s10802-012-9692-x

Brand, A. E., & Klimes-Dougan, B. (2010). Emotion socialization in adolescence: The roles of mothers and fathers. In A. K. Root, S. A. Denham, A. K. Root, & S. A. Denham (Eds.), *Focus on gender: Parent and child contributions to the socialization of emotional competence* (pp. 85–100). San Francisco, CA: Jossey-Bass.

Branje, S. J., van Lieshout, C. F., van Aken, M. A., & Haselager, G. J. (2004). Perceived support in sibling relationships and adolescent adjustment. *Journal of Child Psychology and Psychiatry, 45*, 1385–1396. https://doi.org/10.1111/j.1469-7610.2004.00332.x

Braungart, J. M., & Stifter, C. A. (1991). Regulation of negative reactivity during the strange situation: Temperament and attachment in 12-month-old infants. *Infant Behavior & Development, 14*, 349–364. https://doi.org/10.1016/0163-6383(91)90027-P

Braungart-Rieker, J., Garwood, M. M., Powers, B. P., & Notaro, P. C. (1998). Infant affect and affect regulation during the still-face paradigm with mothers and fathers: The role of infant characteristics and parental sensitivity. *Developmental Psychology, 34*, 1428–1437. https://doi.org/10.1037/0012-1649.34.6.1428

Brenning, K., Soenens, B., Braet, C., & Bosmans, G. (2011). An adaptation of the experiences in Close Relationships Scale-Revised for use with children and adolescents. *Journal of Social and Personal Relationships, 28*, 1048–1072. https://doi.org/10.1177/0265407511402418

Brophy-Herb, H. E., Bocknek, E. L., Vallotton, C. D., Stansbury, K. E., Senehi, N., Dalimonte-Merckling, D., & Lee, Y. (2015). Toddlers with early behavioral problems at higher family demographic risk benefit the most from maternal emotion talk. *Journal of Developmental and Behavioral Pediatrics, 36*, 512–520. https://doi.org/10.1097/dbp.0000000000000196

Brophy-Herb, H. E., Schiffman, R. F., Bocknek, E. L., Dupuis, S. B., Fitzgerald, H. E., Horodynski, M., … Hillaker, B. (2011). Toddlers' social-emotional competence in the contexts of maternal emotion socialization and contingent responsiveness in a low-income sample. *Social Development, 20*, 73–92. https://doi.org/10.1111/j.1467-9507.2009.00570.x

Brophy-Herb, H. E., Stansbury, K., Bocknek, E., & Horodynski, M. A. (2012). Modeling maternal emotion-related socialization behaviors in a low-income sample: Relations with toddlers' self-regulation. *Early Childhood Research Quarterly, 27*, 352–364. https://doi.org/10.1016/j.ecresq.2011.11.005

Brown, G. L., Schoppe-Sullivan, S. J., Mangelsdorf, S. C., & Neff, C. (2010). Observed and reported supportive coparenting as predictors of infant-mother and infant-father attachment security. *Early Child Development and Care, 180*, 121–137. https://doi.org/10.1080/03004430903415015

Brownell, C. A., Nichols, S. R., & Svetlova, M. (2013). Converging developments in prosocial behavior and self-other understanding in the second year of life: The second social-cognitive revolution. In M. R. Banaji, S. A. Gelman, M. R. Banaji, & S. A. Gelman (Eds.), *Navigating the social world: What infants, children, and other species can teach us* (pp. 385–390). New York, NY: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199890712.003.0071

Brownell, C. A., Svetlova, M., Anderson, R., Nichols, S. R., & Drummond, J. (2013). Socialization of early prosocial behavior: Parents' talk about emotions is associated with sharing and helping in toddlers. *Infancy, 18*, 91–119. https://doi.org/10.1111/j.1532-7078.2012.00125.x

Brumariu, L. E., & Kerns, K. A. (2010). Parent-child attachment and internalizing symptoms in childhood and adolescence: A review of empirical findings and future directions. *Development and Psychopathology, 22*, 177–203. https://doi.org/10.1017/S0954579409990344

Brumariu, L. E., Kerns, K. A., & Seibert, A. (2012). Mother–child attachment, emotion regulation, and anxiety symptoms in middle childhood. *Personal Relationships, 19*, 569–585. https://doi.org/10.1111/j.1475-6811.2011.01379.x

Buck, R. (2014). *Emotion: A biosocial synthesis*. New York, NY: Cambridge University Press. https://doi.org/10.1017/CBO9781139049825

Buist, K. L., Deković, M., Meeus, W., & van Aken, M. G. (2004). The reciprocal relationship between early adolescent attachment and internalizing and externalizing problem behaviour. *Journal of Adolescence, 27*, 251–266. https://doi.org/10.1016/j.adolescence.2003.11.012

Burchinal, M. R., Lowe Vandell, D., & Belsky, J. (2014). Is the prediction of adolescent outcomes from early child care moderated by later maternal sensitivity? Results from the NICHD study of early child care and youth development. *Developmental Psychology, 50*, 542–553. https://doi.org/10.1037/a0033709

Burgess, K. B., Marshall, P. J., Rubin, K. H., & Fox, N. A. (2003). Infant attachment and temperament as predictors of subsequent externalizing problems and cardiac physiology. *Journal of Child Psychology and Psychiatry, 44*, 819–831. https://doi.org/10.1111/1469-7610.00167

Buss, K. A. (2011). Which fearful toddlers should we worry about? Context, fear regulation, and anxiety risk. *Developmental Psychology, 47*, 804–819. https://doi.org/10.1037/a0023227

Buss, K. A., Davidson, R. J., Kalin, N. H., & Goldsmith, H. H. (2004). Context-specific freezing and associated physiological reactivity as a dysregulated fear response. *Developmental Psychology, 40*, 583–594. https://doi.org/10.1037/0012-1649.40.4.583

Buss, K. A., Morales, S., Cho, S., & Philbrook, L. (2015). A biopsychosocial framework for infant temperament and socioemotional development. In S. D. Calkins & S. D. Calkins (Eds.), *Handbook of infant biopsychosocial development* (pp. 232–258). New York, NY: Guilford Press.

Busuito, A., & Moore, G. A. (2017). Dyadic flexibility mediates the relation between parent conflict and infants' vagal reactivity during the Face-to-Face Still-Face. *Developmental Psychobiology, 59*, 449–459. https://doi.org/10.1002/dev.21508

Cabrera, N. J., Scott, M., Fagan, J., Steward-Streng, N., & Chien, N. (2012). Coparenting and children's school readiness: A mediational model. *Family Process, 51*, 307–324. https://doi.org/10.1111/j.1545-5300.2012.01408.x

Calkins, S. D. (1994). Origins and outcomes of individual differences in emotion regulation. *Monographs of*

the Society for Research in Child Development, 59, 53–72. https://doi.org/10.2307/1166138

Calkins, S. D. (1997). Cardiac vagal tone indices of temperamental reactivity and behavioral regulation in young children. *Developmental Psychobiology*, 125–135. https://doi.org/10.1002/(SICI)1098-2302(199709)31:2<125::AID-DEV5>3.0.CO;2-M

Calkins, S. D., Dedmon, S. E., Gill, K. L., Lomax, L. E., & Johnson, L. M. (2002). Frustration in infancy: Implications for emotion regulation, physiological processes, and temperament. *Infancy, 3*, 175–197. https://doi.org/10.1207/S15327078IN0302_4

Calkins, S. D., & Johnson, M. C. (1998). Toddler regulation of distress to frustrating events: Temperamental and maternal correlates. *Infant Behavior & Development, 21*, 379–395. https://doi.org/10.1016/S0163-6383(98)90015-7

Calkins, S. D., & Leerkes, E. M. (2010). Early attachment processes and the development of emotional self-regulation. In K. D. Vohs, R. F. Baumeister, K. D. Vohs, & R. F. Baumeister (Eds.), *Handbook of self-regulation: Research, theory, and applications* (2nd ed., pp. 355–373). New York, NY: Guilford Press.

Calkins, S. D., Smith, C. L., Gill, K. L., & Johnson, M. C. (1998). Maternal interactive style across contexts: Relations to emotional, behavioral, and physiological regulation during toddlerhood. *Social Development, 7*, 350–369. https://doi.org/10.1111/1467-9507.00072

Callahan, K. L., Scaramella, L. V., Laird, R. D., & Sohr-Preston, S. L. (2011). Neighborhood disadvantage as a moderator of the association between harsh parenting and toddler-aged children's internalizing and externalizing problems. *Journal of Family Psychology, 25*, 68–76. https://doi.org/10.1037/a0022448

Campbell, S. B., Moore, E. L., Northrup, J., & Brownell, C. A. (2017). Developmental changes in empathic concern and self-understanding in toddlers at genetic risk for autism spectrum disorder. *Journal of Autism and Developmental Disorders, 47*, 2690–2702. https://doi.org/10.1007/s10803-017-3192-3

Carlson, E. A. (1998). A prospective longitudinal study of attachment disorganization/disorientation. *Child Development, 69*, 1107–1128. https://doi.org/10.2307/1132365

Cassidy, J. (1994). Emotion regulation: Influences of attachment relationships. *Monographs of the Society for Research in Child Development, 59*(2–3), 228–283. https://doi.org/10.2307/1166148

Cicchetti, D., & Rogosch, F. A. (2002). A developmental psychopathology perspective on adolescence. *Journal of Consulting and Clinical Psychology, 70*, 6–20. https://doi.org/10.1037//0022-006X.70.1.6

Cole, P. M., & Tan, P. Z. (2007). Emotion socialization from a cultural perspective. In J. E. Grusec, P. D. Hastings, J. E. Grusec, & P. D. Hastings (Eds.), *Handbook of socialization: Theory and research* (pp. 516–542). New York, NY: Guilford Press.

Connell, A. M., Patton, E., Klostermann, S., & Hughes-Scalise, A. (2013). Attention bias in youth: Associations with youth and mother's depressive symptoms moderated by emotion regulation and affective dynamics during family interactions. *Cognition and Emotion, 27*, 1522–1534. https://doi.org/10.1080/02699931.2013.803459

Conway, A. M., Tugade, M. M., Catalino, L. I., & Fredrickson, B. L. (2013). The broaden-and-build theory of positive emotions: Form, function, and mechanisms. In S. A. David, I. Boniwell, A. Conley Ayers, S. A. David, I. Boniwell, & A. Conley Ayers (Eds.), *The Oxford handbook of happiness* (pp. 17–34). New York, NY: Oxford University Press.

Cooke, J. E., Stuart-Parrigon, K. L., Movahed-Abtahi, M., Koehn, A. J., & Kerns, K. A. (2016). Children's emotion understanding and mother–child attachment: A meta-analysis. *Emotion, 16*, 1102–1106. https://doi.org/10.1037/emo0000221

Cox, M. J., Mills-Koonce, R., Propper, C., & Gariépy, J. (2010). Systems theory and cascades in developmental psychopathology. *Development and Psychopathology, 22*, 497–506. https://doi.org/10.1017/S0954579410000234

Crick, N. R., & Grotpeter, J. K. (1995). Relational aggression, gender, and social-psychological adjustment. *Child Development, 66*, 710–722. https://doi.org/10.2307/1131945

Crockenberg, S. C., & Leerkes, E. M. (2004). Infant and maternal behaviors regulate infant reactivity to novelty at 6 months. *Developmental Psychology, 40*, 1123–1132. https://doi.org/10.1037/0012-1649.40.6.1123

Crockenberg, S. C., & Leerkes, E. M. (2006). Infant and maternal behavior moderate reactivity to novelty to predict anxious behavior at 2.5 years. *Development and Psychopathology, 18*, 17–34. https://doi.org/10.1017/S0954579406060020

Crockenberg, S. C., Leerkes, E. M., & Barrig Jó, P. S. (2008). Predicting aggressive behavior in the third year from infant reactivity and regulation as moderated by maternal behavior. *Development and Psychopathology, 20*, 37–54. https://doi.org/10.1017/S0954579408000023

Crockenberg, S. C., Leerkes, E. M., & Lekka, S. K. (2007). Pathways from marital aggression to infant emotion regulation: The development of withdrawal in infancy. *Infant Behavior & Development, 30*, 97–113. https://doi.org/10.1016/j.infbeh.2006.11.009

Cummings, E. M., & Davies, P. T. (2010). *Marital conflict and children: An emotional security perspective*. New York, NY: Guilford Press.

Cummings, E. M., Davies, P. T., & Campbell, S. B. (2000). *Developmental psychpathology and family process: Theory, research, and clinical implications*. New York, NY: Guilford Press.

Cummings, E. M., El-Sheikh, M., Kouros, C. D., & Buckhalt, J. A. (2009). Children and violence: The role of children's regulation in the marital aggression–child adjustment link. *Clinical Child and Family Psychology Review, 12*, 3–15. https://doi.org/10.1007/s10567-009-0042-745444

Cunningham, J. N., Kliewer, W., & Garner, P. W. (2009). Emotion socialization, child emotion

understanding and regulation, and adjustment in urban African American families: Differential associations across child gender. *Development and Psychopathology, 21*, 261–283. https://doi.org/10.1017/S0954579409000157

Cyr, C., Euser, E. M., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2010). Attachment security and disorganization in maltreating and high-risk families: A series of meta-analyses. *Development and Psychopathology, 22*, 87–108. https://doi.org/10.1017/S0954579409990289

Davies, P. T., Sturge-Apple, M. L., & Cicchetti, D. (2011). Interparental aggression and children's adrenocortical reactivity: Testing an evolutionary model of allostatic load. *Development and Psychopathology, 23*, 801–814. https://doi.org/10.1017/S0954579411000319

Davies, P. T., Sturge-Apple, M. L., Cicchetti, D., Manning, L. G., & Zale, E. (2009). Children's patterns of emotional reactivity to conflict as explanatory mechanisms in links between interpartner aggression and child physiological functioning. *Journal of Child Psychology and Psychiatry, 50*, 1384–1391. https://doi.org/10.1111/j.1469-7610.2009.02154.x

Degnan, K. A., Calkins, S. D., Keane, S. P., & Hill-Soderlund, A. L. (2008). Profiles of disruptive behavior across early childhood: Contributions of frustration reactivity, physiological regulation, and maternal behavior. *Child Development, 79*, 1357–1376. https://doi.org/10.1111/j.1467-8624.2008.01193.x

DeJonghe, E. S., Bogat, G. A., Levendosky, A. A., Von Eye, A., & Davidson, W. I. (2005). Infant exposure to domestic violence predicts heightened sensitivity to adult verbal conflict. *Infant Mental Health Journal, 26*, 268–281. https://doi.org/10.1002/imhj.20048

DeJonghe, E. S., von Eye, A., Bogat, G. A., & Levendosky, A. A. (2011). Does witnessing intimate partner violence contribute to toddlers' internalizing and externalizing behaviors? *Applied Developmental Science, 15*, 129–139. https://doi.org/10.1080/10888691.2011.587713

Denham, S. A. (1998). *Emotional development in young children*. New York, NY: Guilford Press.

Denham, S. A., Bassett, H. H., & Brown, C. (2015). "I know how you feel": Preschoolers' emotion knowledge contributes to early school success. *Journal of Early Childhood Research, 13*, 252–262. https://doi.org/10.1177/1476718X13497354

Diener, M. L., Mangelsdorf, S. C., McHale, J. L., & Frosch, C. A. (2002). Infants' behavioral strategies for emotion regulation with fathers and mothers: Associations with emotional expressions and attachment quality. *Infancy, 3*, 153–174. https://doi.org/10.1207/S15327078IN0302_3

Dodge, K. A., & Coie, J. D. (1987). Social-information-processing factors in reactive and proactive aggression in children's peer groups. *Journal of Personality and Social Psychology, 53*, 1146–1158. https://doi.org/10.1037/0022-3514.53.6.1146

Du Rocher Schudlich, T. D., White, C. R., Fleischhauer, E. A., & Fitzgerald, K. A. (2011). Observed infant reactions during live interparental conflict. *Journal of Marriage and Family, 73*, 221–235. https://doi.org/10.1111/j.1741-3737.2010.00800.x

Dunbar, A. S., Leerkes, E. M., Coard, S. I., Supple, A. J., & Calkins, S. (2017). An integrative conceptual model of parental racial/ethnic and emotion socialization and links to children's social-emotional development among African American families. *Child Development Perspectives, 11*, 16–22. https://doi.org/10.1111/cdep.12218

Dunn, J., & Munn, P. (1986). Sibling quarrels and maternal intervention: Individual differences in understanding and aggression. *Journal of Child Psychology and Psychiatry, 27*, 583–595. https://doi.org/10.1111/j.1469-7610.1986.tb00184.x

Dunsmore, J. C., Booker, J. A., Ollendick, T. H., & Greene, R. W. (2016). Emotion socialization in the context of risk and psychopathology: Maternal emotion coaching predicts better treatment outcomes for emotionally labile children with oppositional defiant disorder. *Social Development, 25*, 8–26. https://doi.org/10.1111/sode.12109

ECCRN. (2003). Social functioning in first grade: Prediction from home, child care, and concurrent school experience. *Child Development, 74*, 1639–1662.

Eiden, R. D., Edwards, E. P., & Leonard, K. E. (2007). A conceptual model for the development of externalizing behavior problems among kindergarten children of alcoholic families: Role of parenting and children's self-regulation. *Developmental Psychology, 43*, 1187–1201. https://doi.org/10.1037/0012-1649.43.5.1187

Eiden, R. D., Lessard, J., Colder, C. R., Livingston, J., Casey, M., & Leonard, K. E. (2016). Developmental cascade model for adolescent substance use from infancy to late adolescence. *Developmental Psychology, 52*, 1619–1633. https://doi.org/10.1037/dev0000199

Eisenberg, N., Cumberland, A., & Spinrad, T. L. (1998). Parental socialization of emotion. *Psychological Inquiry, 9*, 241–273. https://doi.org/10.1207/s15327965pli0904_1

Ekas, N. V., Lickenbrock, D. M., & Braungart-Rieker, J. M. (2013). Developmental trajectories of emotion regulation across infancy: Do age and the social partner influence temporal patterns. *Infancy, 18*, 729–754. https://doi.org/10.1111/infa.12003

Engle, J. M., & McElwain, N. L. (2011). Parental reactions to toddlers' negative emotions and child negative emotionality as correlates of problem behavior at the age of three. *Social Development, 20*, 251–271. https://doi.org/10.1111/j.1467-9507.2010.00583.x

Fabes, R. A., Poulin, R. E., Eisenberg, N., & Madden-Derdich, D. A. (2002). The Coping with Children's Negative Emotions Scale (CCNES): Psychometric properties and relations with children's emotional competence. *Marriage & Family Review, 34*, 285–310. https://doi.org/10.1300/J002v34n03_05

Fagan, J., & Lee, Y. (2011). Do coparenting and social support have a greater effect on adolescent fathers than

adult fathers? *Family Relations: An Interdisciplinary Journal of Applied Family Studies, 60*, 247–258. https://doi.org/10.1111/j.1741-3729.2011.00651.x

Fagan, J., & Palkovitz, R. (2011). Coparenting and relationship quality effects on father engagement: Variations by residence, romance. *Journal of Marriage and Family, 73*, 637–653. https://doi.org/10.1111/j.1741-3737.2011.00834.x

Fantuzzo, J., Boruch, R., Beriama, A., & Atkins, M. (1997). Domestic violence and children: Prevalence and risk in five major U.S. cities. *Journal of the American Academy of Child & Adolescent Psychiatry, 36*, 116–122. https://doi.org/10.1097/00004583-199701000-00025

Fearon, R. P., Bakermans-Kranenburg, M. J., van IJzendoorn, M. H., Lapsley, A., & Roisman, G. I. (2010). The significance of insecure attachment and disorganization in the development of children's externalizing behavior: A meta-analytic study. *Child Development, 81*, 435–456. https://doi.org/10.1111/j.1467-8624.2009.01405.x

Federal Interagency Forum on Child and Family Statistics. (2017). *America's children: Key national indicators of Well-being, 2017*. Washington, D.C.: U.S. Government Printing Office.

Feinberg, M. E. (2003). The internal structure and ecological context of coparenting: A framework for research and intervention. *Parenting: Science and Practice, 3*, 95–131. https://doi.org/10.1207/S15327922PAR0302_01

Feinberg, M. E., Jones, D. E., Hostetler, M. L., Roettger, M. E., Paul, I. M., & Ehrenthal, D. B. (2016). Couple-focused prevention at the transition to parenthood, a randomized trial: Effects on coparenting, parenting, family violence, and parent and child adjustment. *Prevention Science, 17*, 751–764. https://doi.org/10.1007/s11121-016-0674-z

Feinberg, M. E., Kan, M. L., & Hetherington, E. M. (2007). The longitudinal influence of coparenting conflict on parental negativity and adolescent maladjustment. *Journal of Marriage and Family, 69*, 687–702. https://doi.org/10.1111/j.1741-3737.2007.00400.x

Feldman, R. (2007). Parent-infant synchrony and the construction of shared timing; Physiological precursors, developmental outcomes, and risk conditions. *Journal of Child Psychology and Psychiatry, 48*, 329–354. https://doi.org/10.1111/j.1469-7610.2006.01701.x

Feldman, R., Singer, M., & Zagoory, O. (2010). Touch attenuates infants' physiological reactivity to stress. *Developmental Science, 13*, 271–278. https://doi.org/10.1111/j.1467-7687.2009.00890.x

Field, T. (2010). Postpartum depression effects on early interactions, parenting, and safety practices: A review. *Infant Behavior & Development, 33*, 1–6. https://doi.org/10.1016/j.infbeh.2009.10.005

Fox, N. A., & Hane, A. A. (2008). Studying the biology of human attachment. In J. Cassidy, P. R. Shaver, J. Cassidy, & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (2nd ed., pp. 217–240). New York, NY: Guilford Press.

Fraley, R. C., Roisman, G. I., & Haltigan, J. D. (2013). The legacy of early experiences in development: Formalizing alternative models of how early experiences are carried forward over time. *Developmental Psychology, 49*, 109–126. https://doi.org/10.1037/a0027852

Frankel, L. A., Umemura, T., Jacobvitz, D., & Hazen, N. (2015). Marital conflict and parental responses to infant negative emotions: Relations with toddler emotional regulation. *Infant Behavior & Development*, *4073*–4083. https://doi.org/10.1016/j.infbeh.2015.03.004

Gangel, M. J., Shanahan, L., Kolacz, J., Janssen, J. A., Brown, A., Calkins, S. D., … Wideman, L. (2017). Vagal regulation of cardiac function in early childhood and cardiovascular risk in adolescence. *Psychosomatic Medicine, 79*, 614–621. https://doi.org/10.1097/PSY.0000000000000458

Garner, P. W. (2003). Child and family correlates of toddlers' emotional and behavioral responses to a mishap. *Infant Mental Health Journal, 24*, 580–596. https://doi.org/10.1002/imhj.10076

Gass, K., Jenkins, J., & Dunn, J. (2007). Are sibling relationships protective? A longitudinal study. *Journal of Child Psychology and Psychiatry, 48*, 167–175. https://doi.org/10.1111/j.1469-7610.2006.01699.x

Gershoff, E. T., & Grogan-Kaylor, A. (2016). Spanking and child outcomes: Old controversies and new meta-analyses. *Journal of Family Psychology, 30*, 453–469. https://doi.org/10.1037/fam0000191

Graham, A. M., Ablow, J. C., & Measelle, J. R. (2010). Interparental relationship dynamics and cardiac vagal functioning in infancy. *Infant Behavior & Development, 33*, 530–544. https://doi.org/10.1016/j.infbeh.2010.07.005

Graham, A. M., Kim, H. K., & Fisher, P. A. (2012). Partner aggression in high-risk families from birth to age 3 years: Associations with harsh parenting and child maladjustment. *Journal of Family Psychology, 26*, 105–114. https://doi.org/10.1037/a0026722

Groh, A. M., Fearon, R. P., IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Roisman, G. I. (2017). Attachment in the early life course: Meta-analytic evidence for its role in socioemotional development. *Child Development Perspectives, 11*, 70–76. https://doi.org/10.1111/cdep.12213

Grych, J. H., & Fincham, F. D. (2001). *Interparental conflict and child development: Theory, research, and applications*. New York, NY: Cambridge University Press. https://doi.org/10.1017/CBO9780511527838

Halberstadt, A. G., & Eaton, K. L. (2002). A meta-analysis of family expressiveness and children's emotion expressiveness and understanding. *Marriage & Family Review, 34*, 35–62. https://doi.org/10.1300/J002v34n01_03

Halberstadt, A. G., & Lozada, F. T. (2011). Emotion development in infancy through the lens of culture. *Emotion Review, 3*, 158–168. https://doi.org/10.1177/1754073910387946

Harms, M. B., Leitzke, B. T., & Pollak, S. D. (2018). Maltreatment and emotional development. In

V. LoBue, K. Perez-Edgar, & K. A. Buss (Eds.), *Handbook of emotional development*. New York, NY: Springer.

Hatfield, E., Cacioppo, J. T., & Rapson, R. L. (1994). *Emotion contagion: Cambridge studies in interaction*. Cambridge, UK: Cambridge University Press.

Hayes, L. J., Goodman, S. H., & Carlson, E. (2013). Maternal antenatal depression and infant disorganized attachment at 12 months. *Attachment & Human Development, 15*, 133–153. https://doi.org/10.1080/14616734.2013.743256

Hentges, R. F., Davies, P. T., & Cicchetti, D. (2015). Temperament and interparental conflict: The role of negative emotionality in predicting child behavioral problems. *Child Development, 86*, 1333–1350. https://doi.org/10.1111/cdev.12389

Hibel, L. C., Granger, D. A., Blair, C., Cox, M. J., & The Family Life Project Key Investigators. (2011). Maternal sensitivity buffers the adrenocortical implications of intimate partner violence exposure during early childhood. *Development and Psychopathology, 23*, 689–701. https://doi.org/10.1017/S0954579411000010

Hill-Soderlund, A. L., Mills-Koonce, W. R., Propper, C., Calkins, S. D., Granger, D. A., Moore, G. A., … Cox, M. J. (2008). Parasympathetic and sympathetic responses to the strange situation in infants and mothers from avoidant and securely attached dyads. *Developmental Psychobiology, 50*, 361–376. https://doi.org/10.1002/dev.20302

Hu, Y., Wang, Y., & Liu, A. (2017). The influence of mothers' emotional expressivity and class grouping on Chinese preschoolers' emotional regulation strategies. *Journal of Child and Family Studies, 26*, 824–832. https://doi.org/10.1007/s10826-016-0606-3

Jahromi, L. B., & Stifter, C. A. (2007). Individual differences in the contribution of maternal soothing to infant distress reduction. *Infancy, 11*, 255–269. https://doi.org/10.1111/j.1532-7078.2007.tb00226.x

Johnson, A. M., Hawes, D. J., Eisenberg, N., Kohlhoff, J., & Dudeney, J. (2017). Emotion socialization and child conduct problems: A comprehensive review and meta-analysis. *Clinical Psychology Review, 54*, 65–80. https://doi.org/10.1016/j.cpr.2017.04.001

Kaplow, J. B., & Widom, C. S. (2007). Age of onset of child maltreatment predicts long-term mental health outcomes. *Journal of Abnormal Psychology, 116*, 176–187. https://doi.org/10.1037/0021-843X.116.1.176

Keiley, M. K., Howe, T. R., Dodge, K. A., Bates, J. E., & Pettit, G. S. (2001). The timing of child physical maltreatment: A cross-domain growth analysis of impact on adolescent externalizing and internalizing problems. *Development and Psychopathology, 13*, 891–912. https://doi.org/10.1111/1467-8624.00055

Kerns, K. A., Abraham, M. M., Schlegelmilch, A., & Morgan, T. A. (2007). Mother-child attachment in later middle childhood: Assessment approaches and associations with mood and emotion regulation. *Attachment & Human Development, 9*, 33–53. https://doi.org/10.1080/14616730601151441

Kestenbaum, R., Farber, E. A., & Sroufe, L. A. (1989). Individual differences in empathy among preschoolers: Relation to attachment history. *New Directions for Child Development, 44*, 51–64. https://doi.org/10.1002/cd.23219894405

Kim, J., & Cicchetti, D. (2010). Longitudinal pathways linking child maltreatment, emotion regulation, peer relations, and psychopathology. *Journal of Child Psychology and Psychiatry, 51*, 706–716. https://doi.org/10.1111/j.1469-7610.2009.02202.x

Klimes-Dougan, B., Brand, A. E., Zahn-Waxler, C., Usher, B., Hastings, P. D., Kendziora, K., & Garside, R. B. (2007). Parental emotion socialization in adolescence: Differences in sex, age and problem status. *Social Development, 16*, 326–342. https://doi.org/10.1111/j.1467-9507.2007.00387.x

Klinnert, M. D., Campos, J., Sorce, J. F., Emde, R. N., & Svejda, M. J. (1983). Social referencing: Emotional expressions as behavior regulations. *Emotion: Theory, Research and Experience, 2*, 57–86. https://doi.org/10.1016/b978-0-12-558702-0.50009-1

Knafo, A., & Plomin, R. (2006). Prosocial behavior from early to middle childhood: Genetic and environmental influences on stability and change. *Developmental Psychology, 42*, 771–786. https://doi.org/10.1037/0012-1649.42.5.771

Kochanska, G., Aksan, N., & Carlson, J. J. (2005). Temperament, relationships, and young children's receptive cooperation with their parents. *Developmental Psychology, 41*, 648–660. https://doi.org/10.1037/0012-1649.41.4.648

Kopp, C. B. (1982). Antecedents of self-regulation: A developmental perspective. *Developmental Psychology, 18*, 199–214. https://doi.org/10.1037/0012-1649.18.2.199

Koss, K. J., & Gunnar, M. R. (2017). Annual research review: Early adversity, the hypothalamic–pituitary–adrenocortical axis, and child psychopathology. *Journal of Child Psychology and Psychiatry*. https://doi.org/10.1111/jcpp.12784

Kramer, L. (2014). Learning emotional understanding and emotion regulation through sibling interaction. *Early Education and Development, 25*, 160–184. https://doi.org/10.1080/10409289.2014.838824

Kwon, K., Jeon, H., & Elicker, J. (2013). Links among coparenting quality, parental gentle guidance, and toddlers' social emotional competencies: Testing direct, mediational, and moderational models. *Journal of Family Studies, 19*, 19–34. https://doi.org/10.5172/jfs.2013.19.1.19

Lamb, M. E., & Lewis, C. (2010). The development and significance of father-child relationships in two-parent families. In M. E. Lamb & M. E. Lamb (Eds.), *The role of the father in child development* (pp. 94–153). Hoboken, NJ: John Wiley & Sons Inc..

Lamb, M. E., Thompson, R. A., Gardner, W. P., Charnov, E. L., & Estes, D. (1984). Security of infantile attachment as assessed in the 'strange situation': Its study and biological interpretation. *Behavioral and*

Brain Sciences, 7, 127–171. https://doi.org/10.1017/S0140525X00026522

Lamela, D., Figueiredo, B., Bastos, A., & Feinberg, M. (2016). Typologies of post-divorce coparenting and parental well-being, parenting quality and children's psychological adjustment. *Child Psychiatry and Human Development, 47*, 716–728. https://doi.org/10.1007/s10578-015-0604-5

Laurent, H. K., Ablow, J. C., & Measelle, J. (2011). Risky shifts: How the timing and course of mothers' depressive symptoms across the perinatal period shape their own and infant's stress response profiles. *Development and Psychopathology, 23*, 521–538. https://doi.org/10.1017/S0954579411000083

Laurent, H. K., Leve, L. D., Neiderhiser, J. M., Natsuaki, M. N., Shaw, D. S., Harold, G. T., & Reiss, D. (2013). Effects of prenatal and postnatal parent depressive symptoms on adopted child HPA regulation: Independent and moderated influences. *Developmental Psychology, 49*, 876–886. https://doi.org/10.1037/a0028800

Lauw, M. M., Havighurst, S. S., Wilson, K. R., Harley, A. E., & Northam, E. A. (2014). Improving parenting of toddlers' emotions using an emotion coaching parenting program: A pilot study of Tuning in to Toddlers. *Journal of Community Psychology, 42*, 169–175. https://doi.org/10.1002/jcop.21602

Leerkes, E. M., Blankson, A. N., & O'Brien, M. (2009). Differential effects of maternal sensitivity to infant distress and nondistress on social-emotional functioning. *Child Development, 80*, 762–775. https://doi.org/10.1111/j.1467-8624.2009.01296.x

Leerkes, E. M., Su, J., Calkins, S. D., O'Brien, M., & Supple, A. J. (2017). Maternal physiological dysregulation while parenting poses risk for infant attachment disorganization and behavior problems. *Development and Psychopathology, 29*, 245–257. https://doi.org/10.1017/S0954579416000122

Leerkes, E. M., Supple, A. J., Su, J., & Cavanaugh, A. M. (2015). Links between remembered childhood emotion socialization and adult adjustment: Similarities and differences between European American and African American women. *Journal of Family Issues, 36*, 1854–1877. https://doi.org/10.1177/0192513X13505567

Leerkes, E. M., & Wong, M. S. (2012). Infant distress and regulatory behaviors vary as a function of attachment security regardless of emotion context and maternal involvement. *Infancy, 17*, 455–478. https://doi.org/10.1111/j.1532-7078.2011.00099.x

Levendosky, A. A., Bogat, G. A., Lonstein, J. S., Martinez-Torteya, C., Muzik, M., Granger, D. A., & von Eye, A. (2016). Infant adrenocortical reactivity and behavioral functioning: Relation to early exposure to maternal intimate partner violence. *Stress: The International Journal on The Biology of Stress, 19*, 37–44. https://doi.org/10.3109/10253890.2015.1108303

Lickenbrock, D. M., Braungart-Rieker, J. M., Ekas, N. V., Zentall, S. R., Oshio, T., & Planalp, E. M. (2013). Early temperament and attachment security with mothers and fathers as predictors of toddler compliance and noncompliance. *Infant and Child Development, 22*, 580–602. https://doi.org/10.1002/icd.1808

Lorber, M. F. (2012). The role of maternal emotion regulation in overreactive and lax discipline. *Journal of Family Psychology, 26*, 642–647. https://doi.org/10.1037/a0029109

Lorber, M. F., Mitnick, D. M., & Slep, A. S. (2016). Parents' experience of flooding in discipline encounters: Associations with discipline and interplay with related factors. *Journal of Family Psychology, 30*, 470–479. https://doi.org/10.1037/fam0000176

Lucas-Thompson, R. G., Lunkenheimer, E. S., & Dumitrache, A. (2017). Associations between marital conflict and adolescent conflict appraisals, stress physiology, and mental health. *Journal of Clinical Child and Adolescent Psychology, 46*, 379–393. https://doi.org/10.1080/15374416.2015.1046179

Lyons-Ruth, K., & Jacobvitz, D. (2016). Attachment disorganization from infancy to adulthood: Neurobiological correlates, parenting contexts, and pathways to disorder. In J. Cassidy & P. R. Shaver (Eds.), *The handbook of attachment* (3rd ed., pp. 667–695). New York, NY: Guilford Press.

Mackrell, S. M., Sheikh, H. I., Kotelnikova, Y., Kryski, K. R., Jordan, P. L., Singh, S. M., & Hayden, E. P. (2014). Child temperament and parental depression predict cortisol reactivity to stress in middle childhood. *Journal of Abnormal Psychology, 123*, 106–116. https://doi.org/10.1037/a0035612

Madigan, S., Atkinson, L., Laurin, K., & Benoit, D. (2013). Attachment and internalizing behavior in early childhood: A meta-analysis. *Developmental Psychology, 49*, 672–689. https://doi.org/10.1037/a0028793

Main, M., & Goldwyn, R. (1984). Predicting rejection of her infant from mother's representation of her own experience: Implications for the abused-abusing intergenerational cycle. *Child Abuse & Neglect, 8*, 203–217. https://doi.org/10.1016/0145-2134(84)90009-7

Main, M., & Hesse, E. (1990). Parents' unresolved traumatic experiences are related to infant disorganized attachment status: Is frightened and/or frightening parental behavior the linking mechanism? In M. T. Greenberg, D. Cicchetti, & E. M. Cummings (Eds.), *Attachment in the preschool years: Theory, research, and intervention* (pp. 161–182). Chicago, IL: University of Chicago Press.

Main, M., & Solomon, J. (1990). Procedures for identifying infants as disorganized/disoriented during the Ainsworth Strange Situation. In M. T. Greenberg, D. Cicchetti, & E. M. Cummings (Eds.), *Attachment in the preschool years: Theory, research, and intervention* (pp. 121–160). Chicago, IL: University of Chicago Press.

Mammen, M. A., Busuito, A., Moore, G. A., Quigley, K. M., & Doheny, K. K. (2017). Physiological functioning moderates infants' sensory sensitivity in higher conflict families. *Developmental Psychobiology, 59*, 628–638. https://doi.org/10.1002/dev.21528davi

Martin, M. J., Sturge-Apple, M. L., Davies, P. T., Romero, C. V., & Buckholz, A. (2017). A process model of the implications of spillover from coparenting conflicts into the parent–child attachment relationship in adolescence. *Development and Psychopathology, 29*, 417–431. https://doi.org/10.1017/S0954579417000086

Martin, S. E., Williamson, L. R., Kurtz-Nelson, E. C., & Boekamp, J. R. (2015). Emotion understanding (and misunderstanding) in clinically referred preschoolers: The role of child language and maternal depressive symptoms. *Journal of Child and Family Studies, 24*, 24–37. https://doi.org/10.1007/s10826-013-9810-6

Mayer, J. D., Salovey, P., & Caruso, D. R. (1997). *Multifactor emotional intelligence scale (MEIS): Emotional intelligence a key to success*. Simsbury, CT: Charles J. Wolfe Associates, LLV Publisher.

McElwain, N. L., Booth-LaForce, C., Lansford, J. E., Wu, X., & Dyer, W. J. (2008). A process model of attachment-friend linkages: Hostile attribution biases, language ability, and mother-child affective mutuality as intervening mechanisms. *Child Development, 79*, 1891–1906. https://doi.org/10.1111/j.1467-8624.2008.01232.x

McElwain, N. L., Halberstadt, A. G., & Volling, B. L. (2007). Mother- and father-reported reactions to children's negative emotions: Relations to young children's emotional understanding and friendship quality. *Child Development, 78*, 1407–1425. https://doi.org/10.1111/j.1467-8624.2007.01074.x

McHale, J. P. (1995). Coparenting and triadic interactions during infancy: The roles of marital distress and child gender. *Developmental Psychology, 31*, 985–996. https://doi.org/10.1037/0012-1649.31.6.985

Mendez, M., Durtschi, J., Neppl, T. K., & Stith, S. M. (2016). Corporal punishment and externalizing behaviors in toddlers: The moderating role of positive and harsh parenting. *Journal of Family Psychology, 30*, 887–895. https://doi.org/10.1037/fam0000187

Mesman, J., Bongers, I. L., & Koot, H. M. (2001). Preschool developmental pathways to preadolescent internalizing and externalizing problems. *Journal of Child Psychology and Psychiatry, 42*, 679–689. https://doi.org/10.1111/1469-7610.00763

Mills-Koonce, W. R., Appleyard, K., Barnett, M., Deng, M., Putallaz, M., & Cox, M. (2011). Adult attachment style and stress as risk factors for early maternal sensitivity and negativity. *Infant Mental Health Journal, 32*, 277–285. https://doi.org/10.1002/imhj.20296

Mills-Koonce, W. R., Willoughby, M. T., Garrett-Peters, P., Wagner, N., & Vernon-Feagans, L. (2016). The interplay among socioeconomic status, household chaos, and parenting in the prediction of child conduct problems and callous–unemotional behaviors. *Development and Psychopathology, 28*, 757–771. https://doi.org/10.1017/S0954579416000298

Minuchin, P. (1985). Families and individual development: Provocations from the field of family therapy. *Child Development, 56*, 289–302. https://doi.org/10.2307/1129720

Mitchell-Copeland, J., Denham, S. A., & DeMulder, E. K. (1997). Q-sort assessment of child-teacher attachment relationships and social competence in the preschool. *Early Education and Development, 8*, 27–39. https://doi.org/10.1207/s15566935eed0801_3

Moed, A., Dix, T., Anderson, E. R., & Greene, S. M. (2017). Expressing negative emotions to children: Mothers' aversion sensitivity and children's adjustment. *Journal of Family Psychology, 31*, 224–233. https://doi.org/10.1037/fam0000239

Moore, G. A. (2009). Infants' and mothers' vagal reactivity in response to anger. *Journal of Child Psychology and Psychiatry, 50*, 1392–1400. https://doi.org/10.1111/j.1469-7610.2009.02171.x

Moore, G. A. (2010). Parent conflict predicts infants' vagal regulation in social interaction. *Development and Psychopathology, 22*, 23–33. https://doi.org/10.1017/S095457940999023X

Moore, G. A., & Calkins, S. D. (2004). Infants' vagal regulation in the still-face paradigm is related to dyadic coordination of mother-infant interaction. *Developmental Psychology, 40*, 1068–1080. https://doi.org/10.1037/0012-1649.40.6.1068

Morgan, J. K., Shaw, D. S., & Olino, T. M. (2012). Differential susceptibility effects: The interaction of negative emotionality and sibling relationship quality on childhood internalizing problems and social skills. *Journal of Abnormal Child Psychology, 40*, 885–899. https://doi.org/10.1007/s10802-012-9618-7

Morris, A. S., Silk, J. S., Steinberg, L., Myers, S. S., & Robinson, L. R. (2007). The role of the family context in the development of emotion regulation. *Social Development, 16*, 361–388. https://doi.org/10.1111/j.1467-9507.2007.00389.x

Moss, E., Parent, S., Gosselin, C., Rousseau, D., & St-Laurent, D. (1996). Attachment and teacher-reported behavior problems during the preschool and early school-age period. *Development and Psychopathology, 8*, 511–525. https://doi.org/10.1017/S0954579400007240

Murphy, S. E., Jacobvitz, D. B., & Hazen, N. L. (2016). What's so bad about competitive coparenting? Family-level predictors of children's externalizing symptoms. *Journal of Child and Family Studies, 25*, 1684–1690. https://doi.org/10.1007/s10826-015-0321-5

Murray, L., Pella, J. E., De Pascalis, L., Arteche, A., Pass, L., Percy, R., … Cooper, P. J. (2014). Socially anxious mothers' narratives to their children and their relation to child representations and adjustment. *Development and Psychopathology, 26*, 1531–1546. https://doi.org/10.1017/S0954579414001187

Nachmias, M., Gunnar, M., Mangelsdorf, S., Parritz, R. H., & Buss, K. (1996). Behavioral inhibition and stress reactivity: The moderating role of attachment security. *Child Development, 67*, 508–522. https://doi.org/10.2307/1131829

Nelson, J. A., Leerkes, E. M., O'Brien, M., Calkins, S. D., & Marcovitch, S. (2012). African American and European American mothers' beliefs about negative emotions and emotion socialization practices.

Parenting: Science and Practice, 12, 22–41. https://doi.org/10.1080/15295192.2012.638871

Nelson, J. A., O'Brien, M., Calkins, S. D., Leerkes, E. M., Marcovitch, S., & Blankson, A. N. (2012). Maternal expressive style and children's emotional development. *Infant and Child Development, 21*, 267–286. https://doi.org/10.1002/icd.748

Nelson, J. A., Freitas, L. B. de L., O'Brien, M., Calkins, S. D., Leerkes, E. M., & Marcovitch, S. (2013). Preschool-aged children's understanding of gratitude: Relations with emotion and mental state knowledge. *British Journal of Developmental Psychology, 31*, 42–56. https://doi-org.libproxy.uncg.edu/10.1111/j.2044-835X.2012.02077.x

NICHD Early Child Care Research Network. (1998). Early child care and self-control, compliance, and problem behavior at twenty-four and thirty-six months. *Child Development, 69*, 1145–1170. https://doi.org/10.2307/1132367

O'Connor, T. G., Heron, J., Golding, J., Beveridge, M., & Glover, V. (2002). Maternal antenatal anxiety and children's behavioural/emotional problems at 4 years: Report from the Avon Longitudinal Study of Parents and Children. *The British Journal of Psychiatry, 180*, 502–508. https://doi.org/10.1192/bjp.180.6.502

Padilla-Walker, L. M., Harper, J. M., & Jensen, A. C. (2010). Self-regulation as a mediator between sibling relationship quality and early adolescents' positive and negative outcomes. *Journal of Family Psychology, 24*, 419–428. https://doi.org/10.1037/a0020387

Pallini, S., Baiocco, R., Schneider, B. H., Madigan, S., & Atkinson, L. (2014). Early child–parent attachment and peer relations: A meta-analysis of recent research. *Journal of Family Psychology, 28*, 118–123. https://doi.org/10.1037/a0035736

Parade, S. H., & Leerkes, E. M. (2011). Marital aggression predicts infant orienting toward mother at six months. *Infant Behavior & Development, 34*, 235–238. https://doi.org/10.1016/j.infbeh.2010.12.005

Parent, J., Jones, D. J., Forehand, R., Cuellar, J., & Shoulberg, E. K. (2013). The role of coparents in African American single-mother families: The indirect effect of coparent identity on youth psychosocial adjustment. *Journal of Family Psychology, 27*, 252–262. https://doi.org/10.1037/a0031477

Patterson, G. R. (2016). Coercion theory: The study of change. In T. J. Dishion, J. J. Snyder, T. J. Dishion, & J. J. Snyder (Eds.), *The Oxford handbook of coercive relationship dynamics* (pp. 7–22). New York, NY: Oxford University Press.

Pauli-Pott, U., & Beckmann, D. (2007). On the association of interparental conflict with developing behavioral inhibition and behavior problems in early childhood. *Journal of Family Psychology, 21*, 529–532. https://doi.org/10.1037/0893-3200.21.3.529

Pearson, J., Tarabulsy, G. M., & Bussières, E. (2015). Fetal programming and cortisol secretion in early childhood: A meta-analysis of different programming variables. *Infant Behavior & Development, 40*, 204–215. https://doi.org/10.1016/j.infbeh.2015.04.004

Perkins, D. F., & Jones, K. R. (2004). Risk behaviors and resiliency within physically abused adolescents. *Child Abuse & Neglect, 28*, 547–563. https://doi.org/10.1016/j.chiabu.2003.12.001

Perry, N. B., Calkins, S. D., & Bell, M. A. (2016). Indirect effects of maternal sensitivity on infant emotion regulation behaviors: The role of vagal withdrawal. *Infancy, 21*, 128–153. https://doi.org/10.1111/infa.12101

Perry, N. B., Leerkes, E. M., Dunbar, A. S., & Cavanaugh, A. M. (2017). Gender and ethnic differences in young adults' emotional reactions to parental punitive and minimizing emotion socialization practices. *Emerging Adulthood, 5*, 83–92. https://doi.org/10.1177/2167696816653856

Perry, N. B., Mackler, J. S., Calkins, S. D., & Keane, S. P. (2014). A transactional analysis of the relation between maternal sensitivity and child vagal regulation. *Developmental Psychology, 50*, 784–793. https://doi.org/10.1037/a0033819

Perry, N. B., Swingler, M. M., Calkins, S. D., & Bell, M. A. (2016). Neurophysiological correlates of attention behavior in early infancy: Implications for emotion regulation during early childhood. *Journal of Experimental Child Psychology, 142*, 245–261. https://doi.org/10.1016/j.jecp.2015.08.007

Philbrook, L. E., Hinnant, J. B., Elmore-Staton, L., Buckhalt, J. A., & El-Sheikh, M. (2017). Sleep and cognitive functioning in childhood: Ethnicity, socioeconomic status, and sex as moderators. *Developmental Psychology, 53*, 1276–1285. https://doi.org/10.1037/dev0000319

Philbrook, L. E., & Teti, D. M. (2016). Associations between bedtime and nighttime parenting and infant cortisol in the first year. *Developmental Psychobiology, 58*, 1087–1100. https://doi.org/10.1002/dev.21442

Pierrehumbert, B., Miljkovitch, R., Plancherel, B., Halfon, O., & Ansermet, F. (2000). Attachment and temperament in early childhood; Implications for later behavior problems. *Infant and Child Development, 9*, 17–32. https://doi.org/10.1002/(SICI)1522-7219(200003)9:1<17::AID-ICD212>3.0.CO;2-#

Pollak, S. D., Cicchetti, D., Hornung, K., & Reed, A. (2000). Recognizing emotion in faces: Developmental effects of child abuse and neglect. *Developmental Psychology, 36*, 679–688. https://doi.org/10.1037/0012-1649.36.5.679

Porges, S. W. (2007). The polyvagal perspective. *Biological Psychology, 74*, 116–143. https://doi.org/10.1016/j.biopsycho.2006.06.009

Porges, S. W., & Furman, S. A. (2011). The early development of the autonomic nervous system provides a neural platform for social behaviour: A polyvagal perspective. *Infant and Child Development, 20*, 106–118. https://doi.org/10.1002/icd.688

Porter, C. L., & Dyer, W. J. (2017). Does marital conflict predict infants' physiological regulation? A short-term prospective study. *Journal of Family Psychology, 31*, 475–484. https://doi.org/10.1037/fam0000295

Porter, C. L., Wouden-Miller, M., Silva, S. S., & Porter, A. E. (2003). Marital harmony and conflict: Linked

to infants' emotional regulation and cardiac vagal tone. *Infancy, 4*, 297–307. https://doi.org/10.1207/S15327078IN0402_09

Propper, C. B., & Holochwost, S. J. (2013). The influence of proximal risk on the early development of the autonomic nervous system. *Developmental Review, 33*, 151–167. https://doi.org/10.1016/j.dr.2013.05.001

Qu, J., Leerkes, E. M., & King, E. K. (2016). Preschoolers' distress and regulatory behaviors vary as a function of infant–mother attachment security. *Infant Behavior & Development, 44*, 144–147. https://doi.org/10.1016/j.infbeh.2016.06.008

Raikes, H. A., & Thompson, R. A. (2006). Family emotional climate, attachment security and young children's emotion knowledge in a high risk sample. *British Journal of Developmental Psychology, 24*, 89–104. https://doi.org/10.1348/026151005X70427

Ramchandani, P. G., Domoney, J., Sethna, V., Psychogiou, L., Vlachos, H., & Murray, L. (2013). Do early father–infant interactions predict the onset of externalising behaviours in young children? Findings from a longitudinal cohort study. *Journal of Child Psychology and Psychiatry, 54*, 56–64. https://doi.org/10.1111/j.1469-7610.2012.02583.x

Reuben, J. D., Shaw, D. S., Neiderhiser, J. M., Natsuaki, M. N., Reiss, D., & Leve, L. D. (2016). Warm parenting and effortful control in toddlerhood: Independent and interactive predictors of school-age externalizing behavior. *Journal of Abnormal Child Psychology, 44*, 1083–1096. https://doi.org/10.1007/s10802-015-0096-6

Rothbart, M. K., & Bates, J. E. (2006). Temperament. In N. Eisenberg (Ed.), *Handbook of child psychology* (pp. 99–166). New York, NY: Wiley.

Schieche, M., & Spangler, G. (2005). Individual differences in biobehavioral organization during problem-solving in toddlers: The influence of maternal behavior, infant-mother attachment, and behavioral inhibition on the attachment-exploration balance. *Developmental Psychobiology, 46*, 293–306. https://doi.org/10.1002/dev.20065

Schneider, B. H., Atkinson, L., & Tardif, C. (2001). Child–parent attachment and children's peer relations: A quantitative review. *Developmental Psychology, 37*, 86–100. https://doi.org/10.1037/0012-1649.37.1.86

Schulz, M. S., Waldinger, R. J., Hauser, S. T., & Allen, J. P. (2005). Adolescents' behavior in the presence of interparental hostility: Developmental and emotion regulatory influences. *Development and Psychopathology, 17*, 489–507. https://doi.org/10.1017/S0954579405050236

Schwartz, O. S., Dudgeon, P., Sheeber, L. B., Yap, M. H., Simmons, J. G., & Allen, N. B. (2012). Parental behaviors during family interactions predict changes in depression and anxiety symptoms during adolescence. *Journal of Abnormal Child Psychology, 40*, 59–71. https://doi.org/10.1007/s10802-011-9542-2

Scrimgeour, M. B., Davis, E. L., & Buss, K. A. (2016). You get what you get and you don't throw a fit!: Emotion socialization and child physiology jointly predict early prosocial development. *Developmental Psychology, 52*, 102–116. https://doi.org/10.1037/dev0000071

Shaffer, A., & Obradović, J. (2017). Unique contributions of emotion regulation and executive functions in predicting the quality of parent–child interaction behaviors. *Journal of Family Psychology, 31*(2), 150–159. https://doi.org/10.1037/fam0000269

Shaw, D. S., Owens, E. B., Giovannelli, J., & Winslow, E. B. (2001). Infant and toddler pathways leading to early externalizing disorders. *Journal of the American Academy of Child & Adolescent Psychiatry, 40*, 36–43. https://doi.org/10.1097/00004583-200101000-00014

Shiner, R. L., Buss, K. A., McClowry, S. G., Putnam, S. P., Saudino, K. J., & Zentner, M. (2012). What is temperament now? Assessing progress in temperament research on the twenty-fifth anniversary of Goldsmith et al. (1987). *Child Development Perspectives, 6*, 436–444.

Song, J., & Volling, B. L. (2015). Coparenting and children's temperament predict firstborns' cooperation in the care of an infant sibling. *Journal of Family Psychology, 29*, 130–135. https://doi.org/10.1037/fam0000052

Spangler, G., & Grossman, K. (1999). Individual and physiological correlates of attachment disorganization in infancy. In J. Solomon, C. George, J. Solomon, & C. George (Eds.), *Attachment disorganization* (pp. 95–124). New York, NY: Guilford Press.

Spinrad, T. L., Eisenberg, N., Gaertner, B., Popp, T., Smith, C. L., Kupfer, A., … Hofer, C. (2007). Relations of maternal socialization and toddlers' effortful control to children's adjustment and social competence. *Developmental Psychology, 43*, 1170–1186. https://doi.org/10.1037/0012-1649.43.5.1170

Spinrad, T. L., Stifter, C. A., Donelan-McCall, N., & Turner, L. (2004). Mothers' regulation strategies in response to toddlers' affect: Links to later emotion self-regulation. *Social Development, 13*, 40–55. https://doi.org/10.1111/j.1467-9507.2004.00256.x

Sroufe, L. A. (1983). Infant-caregiver attachment and patterns of adaptation in preschool: The roots of maladaptation and competence. *Minnesota Symposium in Child Psychology, 16*, 41–81.

Sroufe, L. A. (2005). Attachment and development: A prospective, longitudinal study from birth to adulthood. *Attachment & Human Development, 7*, 349–367. https://doi.org/10.1080/14616730500365928

Sroufe, L. A., & Rutter, M. (1984). The domain of developmental psychopathology. *Child Development, 55*, 17–29. https://doi.org/10.2307/1129832

Steele, H., Steele, M., & Croft, C. (2008). Early attachment predicts emotion recognition at 6 and 11 years old. *Attachment & Human Development, 10*, 379–393. https://doi.org/10.1080/14616730802461409

Stern, D. N. (1985). *The interpersonal world of the infant: A view from psychoanalysis and developmental psychopathology*. New York, NY: Karnac Books.

Stettler, N., & Katz, L. F. (2014). Changes in parents' meta-emotion philosophy from preschool to early ado-

lescence. *Parenting: Science and Practice, 14*, 162–174. https://doi.org/10.1080/15295192.2014.945584

Stifter, C. A., & Augustine, M. E. (2018). Emotion regulation. In V. LoBue, K. Perez-Edgar, & K. A. Buss (Eds.), *Handbook of emotional development*. New York, NY: Springer.

Stover, C. S., Connell, C. M., Leve, L. D., Neiderhiser, J. M., Shaw, D. S., Scaramella, L. V., … Reiss, D. (2012). Fathering and mothering in the family system: Linking marital hostility and aggression in adopted toddlers. *Journal of Child Psychology and Psychiatry, 53*, 401–409. https://doi.org/10.1111/j.1469-7610.2011.02510.x

Sturge-Apple, M. L., Davies, P. T., Cicchetti, D., & Manning, L. G. (2012). Interparental violence, maternal emotional unavailability and children's cortisol functioning in family contexts. *Developmental Psychology, 48*, 237–249. https://doi.org/10.1037/a0025419

Suveg, C., Sood, E., Barmish, A., Tiwari, S., Hudson, J. L., & Kendall, P. C. (2008). 'I'd rather not talk about it': Emotion parenting in families of children with an anxiety disorder. *Journal of Family Psychology, 22*, 875–884. https://doi.org/10.1037/a0012861

Swingler, M. M., Perry, N. B., Calkins, S. D., & Bell, M. A. (2017). Maternal behavior predicts infant neurophysiological and behavioral attention processes in the first year. *Developmental Psychology*. https://doi.org/10.1037/dev0000187

Teubert, D., & Pinquart, M. (2010). The association between coparenting and child adjustment: A meta-analysis. *Parenting: Science and Practice, 10*, 286–307. https://doi.org/10.1080/15295192.2010.492040

Thompson, R. A. (2016). Early attachment and later development: Reframing the questions. In J. Cassidy & P. R. Shaver (Eds.), *The handbook of attachment* (3rd ed., pp. 330–348). New York, NY: Guilford Press.

Tucker, C. J., Finkelhor, D., Turner, H., & Shattuck, A. (2013). 'Association of sibling aggression with child and adolescent mental health': Comment. *Journal of Developmental and Behavioral Pediatrics, 34*, 736. https://doi.org/10.1542/peds.2012-3801d

Umemura, T., Jacobvitz, D., Messina, S., & Hazen, N. (2013). Do toddlers prefer the primary caregiver or the parent with whom they feel more secure? The role of toddler emotion. *Infant Behavior & Development, 36*, 102–114. https://doi.org/10.1016/j.infbeh.2012.10.003

van IJzendoorn, M. H., & Kroonenberg, P. M. (1988). Cross-cultural patterns of attachment: A meta-analysis of the strange situation. *Child Development, 59*, 147–156. https://doi.org/10.2307/1130396

van IJzendoorn, M. H., Schuengel, C., & Bakermans-Kranenburg, M. J. (1999). Disorganized attachment in early childhood: Meta-analysis of precursors, concomitants, and sequelae. *Development and Psychopathology, 11*, 225–249. https://doi.org/10.1017/S0954579499002035

Volling, B. L. (2001). Early attachment relationships as predictors of preschool children's emotion regulation with a distressed sibling. *Early Education and Development, 12*, 185–207. https://doi.org/10.1207/s15566935eed1202_2

Volling, B. L. (2012). Family transitions following the birth of a sibling: An empirical review of changes in the firstborn's adjustment. *Psychological Bulletin, 138*, 497–528. https://doi.org/10.1037/a0026921

Volling, B. L., Gonzalez, R., Oh, W., Song, J., Yu, T., Rosenberg, L., … Stevenson, M. M. (2017). Developmental trajectories of children's adjustment across the transition to siblinghood: Pre-birth predictors and sibling outcomes at one year. *Monographs of the Society for Research in Child Development, 82*, 1–215. https://doi.org/10.1111/mono.12317

Wagner, N. J., Mills-Koonce, W. R., Willoughby, M. T., & Cox, M. J. (2017). Parenting and cortisol in infancy interactively predict conduct problems and callous–unemotional behaviors in childhood. *Child Development*. https://doi.org/10.1111/cdev.12900

Wagner, N. J., Propper, C., Gueron-Sela, N., & Mills-Koonce, W. R. (2016). Dimensions of maternal parenting and infants' autonomic functioning interactively predict early internalizing behavior problems. *Journal of Abnormal Child Psychology, 44*, 459–470. https://doi.org/10.1007/s10802-015-0039-2

Waller, M. R. (2012). Cooperation, conflict, or disengagement? Coparenting styles and father involvement in fragile families. *Family Process, 51*, 325–342. https://doi.org/10.1111/j.1545-5300.2012.01403.x

Warren, S. L., Huston, L., Egeland, B., & Sroufe, L. A. (1997). Child and adolescent anxiety disorders and early attachment. *Journal of the American Academy of Child & Adolescent Psychiatry, 36*, 637–644. https://doi.org/10.1097/00004583-199705000-00014

Westrupp, E. M., Rose, N., Nicholson, J. M., & Brown, S. J. (2015). Exposure to inter-parental conflict across 10 years of childhood: Data from the longitudinal study of Australian children. *Maternal and Child Health Journal, 19*, 1966–1973. https://doi.org/10.1007/s10995-015-1704-3

Whiteman, S. D., Solmeyer, A. R., & McHale, S. M. (2015). Sibling relationships and adolescent adjustment: Longitudinal associations in two-parent African American families. *Journal of Youth and Adolescence, 44*, 2042–2053. https://doi.org/10.1007/s10964-015-0286-0

Wu, X., Wang, Y., & Liu, A. (2017). Maternal emotional expressiveness affects preschool children's development of knowledge of display rules. *Social Behavior and Personality, 45*, 93–104. https://doi.org/10.2224/sbp.5783

Zahn-Waxler, C., Radke-Yarrow, M., & King, R. A. (1979). Child rearing and children's prosocial initiations toward victims of distress. *Child Development, 50*, 319–330. https://doi.org/10.2307/1129406

Zahn-Waxler, C., Shirtcliff, E. A., & Marceau, K. (2008). Disorders of childhood and adolescence: Gender and psychopathology. *Annual Review of Clinical Psychology*, *4*275–4303. https://doi.org/10.1146/annurev.clinpsy.3.022806.091358

Zhou, N., Cao, H., & Leerkes, E. M. (2017). Interparental conflict and infants' behavior problems: The mediating role of maternal sensitivity. *Journal of Family Psychology, 31*, 464–474. https://doi.org/10.1037/fam0000288

Zimet, D. M., & Jacob, T. (2001). Influences of marital conflict on child adjustment: Review of theory and research. *Clinical Child and Family Psychology Review, 4*, 319–335. https://doi.org/10.1023/A:1013595304718

Zvara, B. J., Sheppard, K. W., & Cox, M. (2018). Bidirectional effects between parenting sensitivity and child behavior: A cross-lagged analysis across middle childhood and adolescence. *Journal of Family Psychology*. https://doi.org/10.1037/fam0000372

Part IV

Atypical Emotional Development

Emotional Development and Anxiety

Elizabeth J. Kiel and Anne E. Kalomiris

Abstract

Emotion processes are related to anxiety symptoms and disorders across the lifespan. This chapter uses emotional development as an explicit framework for understanding these associations, focusing mainly on child and adolescent populations. We begin by reviewing empirical studies of emotion reactivity, emotion regulation, and associated constructs as they relate to clinically relevant anxiety. These emotion processes are then reviewed from the developmental literature, highlighting how individual differences in temperament and attachment may steer some children along trajectories of emotion development that put them at risk for anxiety. Factors that contextualize or provide mechanisms of the shift from typical development to clinically relevant anxiety outcomes include gender, attention biases and information processing, parenting, and culture. Finally, we review how emotion development has currently been incorporated into anxiety treatment and prevention. We offer suggestions for further incorporation of emotional development into the study of anxiety and the development of appropriate interventions.

E. J. Kiel (✉) · A. E. Kalomiris
Department of Psychology, Miami University, Oxford, OH, USA
e-mail: Elizabeth.Kiel@MiamiOH.edu

Anxiety disorders in childhood are associated with significant social, emotional, and academic consequences (Costello, Egger, & Angold, 2005). This cluster of debilitating disorders can be observed as early as preschool, with epidemiological estimates indicating that 7–11% of children under 5 demonstrate clinically significant symptoms of anxiety (Costello et al., 2005). Early anxiety disorders can be chronic and further increase the likelihood of being diagnosed with future psychiatric disorders, including depression, conduct disorder, substance use, and other specific forms of anxiety (Bittner et al., 2007; Costello, Mustillo, Erkanli, Keeler, & Angold, 2003). This may account for anxiety's increasing prevalence across the childhood and adolescent periods, as lifetime estimates reveal that up to 27% of children will receive a diagnosis of anxiety (Costello et al., 2005). The present chapter will not address specific anxiety disorders exhaustively, but will rather examine anxiety's emergence and correlates from the lens of emotional development. This approach aligns with psychology's increasing emphasis on transdiagnostic factors, like heightened emotion reactivity and emotion dysregulation, responsible for psychopathology (Craske, 2012; Kring & Sloan, 2009). Further, this approach is consistent with the recognized intersection between emotion and cognition. Across the lifespan, anxiety is associated with heightened emotional and physiological reactivity and, especially at later ages, cognitive

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_25

biases toward negative feedback from and threat in the environment. Cognitive (also, information processing) models of anxiety posit that these biases toward negative or threat-relevant thoughts, perceptions, and interpretations of stimuli, people, and situations play a key role in the emotional, physiological, and behavioral features of anxiety. Although aspects of emotion development are certainly relevant for adults, and there has been increased attention toward emotion regulation, in particular (e.g., Aldao, Nolen-Hoeksma, & Schweizer, 2010; Brozovich et al., 2015; Mennin, 2004) in both the phenomenology and treatment of adult anxiety, we focus primarily on childhood and adolescence, as these periods are most immediately affected by ongoing emotion development.

A developmental psychopathology approach is useful for understanding the role of emotion development in the risk for and onset of anxiety problems. The developmental psychopathology perspective suggests that abnormal or atypical outcomes can be understood as a deviation from typical development (Rutter & Sroufe, 2000; Sroufe & Rutter, 1984). Typical emotion development is a dynamic process influenced by a several contextual factors including biological functioning, cognitive abilities, and familial interactions (Jacob, Thomassin, Morelen, & Suveg, 2011; Murray, Creswell, & Cooper, 2009). Although it is beyond the scope of this present chapter to review the impact of these specific factors on emotional development in children (see Murray et al., 2009 or Jacob et al., 2011 for a review), their resulting consequences for the development of emotional processes are profound. The inherently adaptive nature of emotions, interconnections between cognition and emotion, and the motivational functions of emotion have been specifically highlighted as reason to focus on emotion when understanding the relation between abnormal and normal development (Izard, Fine, Mostow, Trentacosta, & Campbell, 2002). In this vein, we review maladaptation in emotion development apparent in children and adolescents displaying clinically significant anxiety and then examine how variations in typical development (e.g., temperament and attachment) may predict these problems. We consider other variables that determine the strength or mechanism of the association between emotion development and anxiety. Finally, we review prevention and intervention work that has incorporated emotion development and suggest areas for future directions.

Emotion Development in Youth Anxiety Disorders

Fear and anxiety are normative aspects of development. As a primary emotion, fear appears early in life and offers adaptive functions throughout the lifespan. In infancy, fear and separation anxiety prompt behaviors (e.g., crying, clinging) that keep infants close to caregivers to ensure basic needs are met; in childhood, typical fears of animals, storms, and physical danger keep children away from harm; in adolescence and adulthood, fear of negative evaluation and social concerns assist with the navigation of closeness and conflict in peer and romantic relationships (Boyle & O'Sullivan, 2013; Caouette & Guyer, 2014; Gullone & King, 1993; LoBue & DeLoache, 2008; Öhman, 2008). As such, in their normative forms, fear and anxiety support the development of competence in key tasks at each stage of the lifespan. Across early childhood, heightened emotional arousal associated with these fears is primarily managed by caregivers, but as children's neural and motor systems mature they grow increasing independence in self-regulation (Calkins & Hill, 2007). In line with this, many fears tend to decrease across childhood and into adolescence, although social anxiety and worry become more prominent as children age, perhaps due to increased cognitive sophistication (Gullone & King, 1997; Gullone, King, & Ollendick, 2001; Muris, Merckelbach, Gadet, & Moulaert, 2000). When fear and anxiety cause an individual undue distress, impair functioning, and interfere with typical developmental tasks, they cross the boundary from typical development to be considered more pathological. Aspects of emotion development can help us differentiate the atypical from the typical nature of fear and

anxiety. Emotion development focuses on emotion reactivity, emotion regulation, emotion understanding, and broader emotion competence. A host of empirical work reveals that these components of emotion differ in distinct ways between children with versus without anxiety disorders and suggests that heightened reactivity, dysregulation, diminished understanding, and low perceived competence together characterize anxious youth.

Emotion Reactivity

Both empirical work and theory suggest that anxiety disorders in children are characterized by heightened emotional reactivity (Clark & Watson, 1991; Suveg, Morelen, Brewer, & Thomassin, 2010). Emotion reactivity can be seen through anxious children's tendency to experience more negative affect compared to non-anxious children (Hughes & Kendall, 2009; Joiner, Catanzaro, & Laurent, 1996). This reflects anxious children's increased levels of subjective distress and general displeasure with their surrounding environment, as well as patterns of hyperarousal. This general hyperarousal may be physiological, though equivocal evidence exists regarding the neurological, cardiovascular, and endocrinological patterns of activation for anxiety-prone individuals (Badanes, Watamura, & Hankin, 2011; Bress, Meyer, & Hajcak, 2015; Guyer et al., 2012; Meyer et al., 2013; Shirtcliff, Peres, Dismukes, Lee, & Phan, 2014; Weems, Zakem, Costa, Cannon, & Watts, 2005).

More consistent evidence reveals distinct patterns of neurological activity in children with anxiety. Research into the neurological underpinnings of anxiety has largely focused on amygdala activation due to its integral role in fear perception (e.g., Pine, 2007). Patterns of amygdala activation have been used to distinguish anxiety from depression (Beesdo et al., 2009), suggesting the amygdala is particularly relevant for the development of anxiety-specific symptoms relative to other internalizing disorders. Specifically, hyperactivity of the amygdala and associated neural circuits has been associated with anxiety in the context of social threat in adolescents (Guyer et al., 2008; Lau et al., 2012; McClure et al., 2007). This pattern of hyperactivation also persists longer after the presentation of an emotion-eliciting stimulus for anxious versus non-anxious adolescents (Lau et al., 2012). This suggests that patterns of heightened emotional reactivity characterizing anxiety may therefore be rooted in neurological functioning.

Robust evidence indicates that anxious children also experience more subjective emotional hyperarousal, perhaps suggesting heightened sensitivity to physiological activation (Weems et al., 2005). Indeed, children with anxiety disorders report more frequent and intense negative emotional responses to threatening pictures (Carthy, Horesh, Apter, Edge, & Gross, 2010), ambiguous situations (Carthy, Horesh, Apter, & Gross, 2010), and emotion-eliciting vignettes (Suveg & Zeman, 2004). Such enhanced reactivity may be responsible for the dysregulated expression of emotions characteristic of individuals with anxiety (Suveg & Zeman, 2004).

The existing literature therefore suggests that increased emotional reactivity is associated with anxiety problems across childhood. The child's emotion experience certainly can impact a response to that emotion, though reactivity itself is not directly predictive of emotion regulation capabilities (Carthy, Horesh, Apter, & Gross, 2010; Ursache, Blair, Stifter, & Voegtline, 2013). It is therefore important to separately consider children's abilities to regulate their emotional experience when understanding anxious emotional experiences.

Emotion Regulation

Emotion regulation refers to attempts to manage emotional arousal (Cole, Martin, & Dennis, 2004). Individuals who experience challenges regulating their emotions in adaptive and flexible ways are at an increased risk for developing several forms of psychopathology, including anxiety disorders (Casey, 1996; Cicchetti, Ackerman, & Izard, 1995; Cisler, Olatunji, Feldner, & Forsyth, 2010; Mathews, Kerns, & Ciesla, 2014).

Specifically, global emotion dysregulation alone may account for up to 24% of the variance of anxiety disorders by middle childhood (Bender, Reinholdt-Dunne, Esbjørn, & Pons, 2012). Despite this, only recently has empirical work started to focus on emotion dysregulation's relation to anxiety disorders in children.

Extant investigations have disentangled the effects of global emotion dysregulation on anxiety by examining anxiety's relation to specific emotion regulation strategies. Rather than assigning valence to specific strategies, leading theorists agree that effective emotion regulation strategy use is flexible, fluid, and contingent on situational demands (Campos, Frankel, & Camras, 2004; Cole et al., 2004; Cole, Michel, & Teti, 1994; Thompson, 1994). There are, however, strategies that appear to be generally adaptive or maladaptive, and when labeled in this way, anxious children are generally more likely to use maladaptive strategies (Bender, Pons, Harris, Esbjørn, & Reinholdt-Dunne, 2015).

Emotion regulation strategies that are generally considered adaptive include behaviors such as coping to manage the intensity and duration of negative and positive emotions, reappraisal to regulate cognitions about experienced emotions, acceptance of emotional arousal, and general problem-solving strategies (Zeman, Shipman, & Penza-Clyve, 2001). There is some evidence that anxious children may not use adaptive strategies as effectively as non-anxious children. Specifically, when presented with ambiguous situations that spanned various contexts (i.e., social, physical, performance), children with anxiety experienced more difficulty using reappraisal to manage their negative emotions (Carthy, Horesh, Apter, Edge, & Gross, 2010). Even when cued to reappraise their emotional experience, anxious children were less likely to do so effectively (Carthy, Horesh, Apter, Edge, & Gross, 2010; Carthy, Horesh, Apter, & Gross, 2010). This facet of emotion regulation is particularly important, as spontaneous reappraisal has been related to better-managed anxiety symptoms (Carthy, Horesh, Apter, & Gross, 2010). Interestingly, a recent meta-analysis revealed that anxious children actually do not differ from non-anxious children in their use of adaptive cognitive coping, acceptance of their emotions, and problem-solving (Mathews, Koehn, Abtahi, & Kerns, 2016). Perhaps this suggests that anxious children may not differ in the ability and frequency of implementing these positive emotion regulation strategies.

Strategies associated with poorly regulated negative emotional arousal, or those that are generally considered maladaptive, include behaviors such as inhibition of positive emotion, suppression of negative emotion, and avoidance of emotions (Zeman et al., 2001). Children with anxiety report more suppression of negative emotions such as worry (Suveg & Zeman, 2004) and are more likely to endorse seeking help from others or avoiding feared situations (Carthy, Horesh, Apter, & Gross, 2010; Mathews et al., 2016), despite the fact that these emotion regulation strategies are associated with greater anxiety. Coupled with meta-analytic findings regarding positive regulation strategies, perhaps the consequences of frequent negative strategy use outweigh more positive attempts at emotion regulation in anxious youth (Mathews et al., 2016).

From the above research regarding emotion regulation and anxiety, it is clear that future work should align with the field's understanding of emotion regulation as fluid and contextually dependent. In order to more comprehensively understand emotion regulation strategy use in anxious youth, future research should operationalize flexibility to determine the profiles of emotion regulation strategy use characteristic of children with anxiety relative to non-anxious controls. It may be beneficial to examine the strategies that are associated with reductions in negative affect and compare these to strategies that are less effective in reducing negative emotions in anxiety-prone children.

Emotional Understanding and Competence

In addition to the heightened emotional reactivity and limited regulation strategy use characteristic of anxious youth, anxiety may also impact the

development of emotion awareness and understanding, or the way in which an individual understands and evaluates their own and others' emotions (Rieffe, Oosterveld, Miers, Terwogt, & Ly, 2008). Emotion awareness includes an understanding of feeling cues, mixed emotions, and emotion display rules. A recent meta-analysis of 21 studies revealed that anxious children demonstrate less awareness of emotions than their non-anxious counterparts, with particularly large effect sizes in childhood relative to adolescence (Sendzik, Schäfer, Samson, Naumann, & Tuschen-Caffier, 2017). This supports speculation that a lack of emotional awareness and clarity underlies anxiety in youth, perhaps most so for younger children, who have less developed and versatile emotion regulation capabilities (Bender et al., 2015). Additional research has revealed that youth without anxiety better understand how to hide and change emotions relative to anxious youth, but that these groups do not differ in their understanding of mixed emotions (Southam-Gerow & Kendall, 2000). Findings such as these imply that interventions in early childhood that target emotion understanding may be particularly effective for the prevention of anxiety disorders (Barrett & Turner, 2001).

Emotional understanding certainly influences children's perceptions of their abilities to regulate their own emotions. This insight into a child's ability to control emotion is referred to as emotion competence, and it also differs in distinct ways for children with anxiety. Children with anxiety perceive themselves as less capable of regulating their negative affect (Weems, Silverman, Rapee, & Pina, 2003), particularly when it relates to worry (Suveg & Zeman, 2004). When negative emotions are elicited in a laboratory setting, anxious children report that reappraisal is less likely to improve their negative affect in response to ambiguity (Carthy, Horesh, Apter, & Gross, 2010). Actual and perceived control over one's own anxiety may also impact the presentation of symptoms (Weems & Silverman, 2006), as diminished perceptions of control of negative emotional and physiological responses to anxiety are robustly associated with more severe anxiety symptoms (Ginsburg, Siqueland, Masia-Warner, & Hedtke, 2004; Rapee, Craske, Brown, & Barlow, 1996). Similar to emotion understanding, control may also be an excellent target for intervention. Indeed, children who feel confident managing their anxious responses demonstrate the largest post-treatment gains following conventional treatment (Muris, Mayer, den Adel, Roos, & van Wamelen, 2009).

From the existing research, it is clear that anxious youth demonstrate distinct profiles of emotion reactivity, regulation, and understanding, which can impact the tendency to experience anxious emotions. The early developmental period is pivotal for establishing these patterns of anxious thought and responsivity, though it is also essential to consider how this is maintained in adulthood.

Emotion Reactivity and Regulation in Adults

A brief review of the primary features of emotion development and their relation to anxiety in adulthood may assist in placing child and adolescent anxiety. Evidence suggests that the patterns of emotional reactivity and regulation that characterize anxious youth also persist into adulthood. A host of literature suggests that anxiety disordered adults experience their emotions with more intensity and are more labile in their emotional expression, particularly for adults diagnosed with generalized anxiety disorder (e.g., Mennin, Heimberg, Turk, & Fresco, 2002).

Anxiety disorders in adults are also marked by deficits in emotion regulation. Specific difficulties have been noted regarding emotional clarity, understanding emotions, accepting emotions, engaging in goal-directed behaviors, controlling impulses, and accessing effective emotion regulation strategies (Mennin, Heimberg, Turk, & Fresco, 2005; Salters-Pedneault, Roemer, Tull, Rucker, & Mennin, 2006). Recent work suggests that emotion regulation skills including acceptance, tolerance, and willingness to address emotions are negatively associated with anxiety symptoms 5 years later while controlling for current anxiety symptomology (Wirtz, Hofmann,

Riper, & Berking, 2014). This suggests that difficulties in emotion regulation may compound over time and worsen anxiety severity in adults. Theoretical models also propose that inflexibly applying emotion regulation strategies actually strengthens the relation among heightened emotional reactivity, negative emotions, and future symptoms of anxiety (Cisler et al., 2010).

Taken together, emotion reactivity and regulation capacities and strategies in anxious adults mirror the difficulties that anxious children experience, suggesting that early emotional development sets the foundation for anxiety-relevant emotion experiences throughout the lifespan. This underscores the importance of examining the early trajectory of atypical emotion development. Thus, we next turn to understanding how these altered emotion processes arise from fluctuations in typical emotion development.

Emotion Development and Developmental Precursors to Anxiety

Typically, we expect that children experience moderate amounts of many emotions, show flexibility in displaying their emotions, and show increasing capacities for managing emotional arousal in a way that allows them to function within their environments. Moreover, we expect that children develop these tendencies within interpersonal relationships with caregivers and peers that are mutually responsive and shape adaptive functioning. Therefore, more extreme levels of emotion reactivity/arousal and difficulties regulating that reactivity would be of primary targets for understanding the development of anxiety. Indeed, individual differences in emotional development stemming from both intrapersonal and interpersonal processes have been linked to risk for anxiety problems.

Temperament

Temperament is a useful organizational framework for understanding how specific patterns in emotion development may confer risk for anxiety. Temperament reflects biologically based individual differences in tendencies to respond to the environment with either general emotion reactivity or particular emotions, as well as individual differences in the regulation of those responses (Goldsmith et al., 1987; Goldsmith & Campos, 1982; Rothbart & Derryberry, 1981). Therefore, although biological systems and structures involved in managing stress and arousal (e.g., neuroendocrine system, autonomic nervous system, prefrontal cortex, among others) show universal aspects of maturation from infancy to later development, temperament inclines some individuals, from very early life, to experience more arousal in response to environmental stimulation and have difficulty managing that arousal.

One particular profile of individual differences relevant to anxiety development is fearful temperament (also, inhibited temperament or behavioral inhibition). Although other aspects of temperament, such as negative affectivity, more broadly, as well as the domain of effortful control, have been linked to anxiety development (Hankin et al., 2017; Lonigan & Phillips, 2001), fearful temperament remains one of the most well studied and robust predictors of anxiety. Behaviorally, children displaying heightened fearful temperament tend to withdraw from, avoid, and display fear and wariness in response to novel people, situations, and objects. Kagan's foundational work on behavioral inhibition (BI) identified qualitative differences between BI children, identified behaviorally, and their less inhibited peers (Kagan, Reznick, Clarke, Snidman, & Garcia-Coll, 1984). BI children were more likely to show a pattern of negative affect and motor activity in response to stimulation as infants, in line with theory that temperamental reactivity appears very early in life (Kagan & Snidman, 1991). As toddlers and young children, BI children showed a profile of heightened arousal, characterized biologically through cortisol reactivity, larger pupillary dilations, higher and less variable heart rates, and right frontal EEG asymmetry (Kagan, Reznick, & Snidman, 1988; Kagan & Snidman, 1999; Reznick et al., 1986), findings that have been corroborated in other samples (Fox, Henderson, Rubin, Calkins, & Schmidt, 2001; Hane, Fox, Henderson, &

Marshall, 2008; Pérez-Edgar, Kujawa, Nelson, Cole, & Zapp, 2013). Kagan theorized these biological differences to be downstream effects from activity of the amygdala (Kagan, Snidman, Arcus, & Reznick, 1994). Amygdala activation is an adaptive response that prompts the body's readiness to deal with threat in the environment. However, when the amygdala has a lower than typical threshold for activation, novel stimuli more easily rise to the level of "threat," activating fear and arousal. Heightened amygdala activity and its downstream physiological effects may persist over the course of development. Indeed, toddlers identified as behaviorally inhibited continue to demonstrate a low threshold for amygdala activity as adults (Schwartz, Wright, Shin, Kagan, & Rauch, 2003; Roy et al., 2014), and this amygdala activity is implicated in clinically significant anxiety across the lifespan (Beesdo et al., 2009; Guyer et al., 2008; Guyer et al., 2012; Lau et al., 2012; McClure et al., 2007; Pine, 2007). When measured dimensionally, fearful temperament also correlates with biological substrates of reactivity, although perhaps less strongly than when using an extreme groups approach (Essex, Klein, Slattery, Goldsmith, & Kalin, 2010; Kertes et al., 2009; Talge, Donzella, & Gunnar, 2008; Van Hulle, Moore, Lemery-Chalfant, Goldsmith, & Brooker, 2017). Thus, temperamentally fearful children demonstrate heightened fear reactivity.

Given the experiences of heightened reactivity, temperamentally fearful children may be predisposed to regulate their emotional arousal by behaviorally limiting environmental input that would stimulate it. Thus, they may learn to rely on strategies of withdrawal from or avoidance of novel, uncertain, and/or potentially threatening situations as well as more intense attempts to control the environment (Thompson & Calkins, 1996). Although adaptive in the immediate sense because they allow children to maintain a manageable level of emotional arousal, these strategies become maladaptive in that they may prevent children from accomplishing developmental competencies, such as gaining mastery over the environment and effectively engaging with peers who could become important sources of social support. Perhaps entrenchment in these patterns across development underlies the intolerance of uncertainty and high need for control characteristic of children with anxiety disorders.

Temperamentally fearful children also differ from others in terms of neurobiological bases of regulation. Imaging studies have shown that, while required to direct attention away from threat, temperamentally fearful children show greater activation in the right dorsolateral prefrontal cortex (PFC) and that fearful temperament accounted for the link between this activation and anxiety (Fu, Taber-Thomas, & Pérez-Edgar, 2017). The authors argued that these results suggest that temperamentally fearful children may be engaging the executive attention system (of which dorsolateral PFC is a component) more than non-fearful children as top-down regulation of their tendencies toward vigilance in order to perform the task. Other work in delta-beta coupling makes a similar conclusion about potential neural over-regulation in temperamentally fearful children. Delta (slow-wave) electrophysiological activity is thought to reflect subcortical activity relevant to emotion processing, among other functions. Beta (fast-wave) activity is thought to reflect cortical processes relevant to attention and cognition. Higher coupling between oscillations in these frequency bands is thought to reflect a greater degree of cortical regulation of subcortical processes, or greater cognitive regulation of emotion processes. Significant delta-beta coupling in frontal regions has been found in anxiety-prone youth (Miskovic et al., 2011) as well as toddlers displaying dysregulated fear (Phelps, Brooker, & Buss, 2016). Thus, cognitively mediated overregulation may link fearful temperament and anxiety. It will be critical for future research to also study cognitively based emotion regulation strategies (e.g., experiential avoidance, rumination, suppression, reappraisal) in the context of fearful temperament, neural activation and connectivity, and anxiety.

Fearful temperament is one of the most robust predictors of anxiety disorders in later childhood, adolescence, and adulthood (Biederman et al., 1993; Essex et al., 2010; Hirshfeld-Becker et al., 2007; Kagam, Snidman, Zentner, & Peterson,

1999; Mian, Wainwright, Briggs-Gowan, & Carter, 2011). One challenge for understanding the association between fearful temperament and onset of anxiety symptoms and disorders, however, is that only a fraction of temperamentally fearful children go on to develop clinically significant anxiety problems. This reflects the concept of multifinality (Cicchetti & Rogosch, 1996), such that a similar beginning (i.e., fearful temperament) may lead to a number of different outcomes, only some of which are characterized by clinically significant anxiety. The predictive association between fearful temperament and later anxiety (or anxious behavior) seems to be stronger when using an extreme groups approach as compared to a dimensional approach, as well as when considering stability in fearful temperament across time (Chronis-Tuscano et al., 2009; Kagan, Reznick, & Gibbons, 1989; Prior, Smart, Sanson, & Oberklaid, 2000). Further, social aspects of fearful temperament may be a specific risk for social anxiety (Brooker, Kiel, & Buss, 2016; Dyson, Klein, Olino, Dougherty, & Durbin, 2011; Hirshfeld-Becker et al., 2007), so predictive associations would be expected to be stronger when examining this specific pathway. Even with these considerations, estimates of the relation between fearful temperament and anxiety are modest. This suggests that children identified to have temperamental risk toward anxiety are a heterogeneous group, including both children who will and will not go on to develop anxiety.

One advance from the emotion development literature has been the establishment of the construct of dysregulated fear (Buss, 2011), which refers to displays of high levels of fear that mismatch the low-fear nature of an eliciting context. Attention to the context in which fear is elicited is consistent with broader theory on emotion regulation as encompassing the ability to flexibly adapt emotional experience to the situation (e.g., Cole et al., 2004). For both categorical (i.e., behavioral inhibition) and dimensional approaches to fearful temperament, children's behavior has traditionally been observed across a variety of contexts, and scores are then averaged together. Alternatively, fear may be observed in a context that reliably elicits fear across most children, such as a remote-controlled spider task or an intrusive stranger approach (Buss, Davidson, Kalin, & Goldsmith, 2004; Buss & Goldsmith, 2000). However, not all contexts may highlight maladaptive levels of fear. Contexts characterized by a high level of threat may elicit fear across most children and thus represent an adaptive, somewhat universal response. Fear expressions and difficulties regulating them may therefore fail to identify children who are prone to anxiety. Situations that are novel yet less threatening because they offer children a wider range of coping opportunities and perhaps more closely resemble encounters in daily life may less widely elicit fear. Thus, children who adequately cope with novelty will show low levels of fear and higher levels of engagement. A small number of children, however, will still find these situations threatening and display fear, withdrawal, and avoidance. Thus, situations that are novel yet low in threat may highlight, more specifically, which children are at risk. This is precisely what Buss (2011) found. Although dysregulated fear understandably shared variance with a more traditional measure of fearful temperament, dysregulated fear predicted parent- and teacher-reported anxiety above and beyond traditional inhibited temperament. This suggests that dysregulated fear more precisely identifies children at risk for anxiety. In a follow-up study, Buss et al. (2013) found that dysregulated fear predicted social anxiety disorder symptoms from a parent clinical interview. Thus, context-inappropriate experiences of fear may particularly mark risk.

Fearful temperament therefore describes a profile of increased emotion reactivity, especially in the domain of fear, and indices of emotion regulation that assist in managing arousal in the moment but result in over-regulation in many contexts. Of course, children develop not only from their intrapersonal characteristics, but also within interpersonal relationships. Although many social contexts (e.g., parents, peers, classrooms, work) impact develop, we focus on

attachment, given its strong implications for emotion development.

Attachment

One of the first developmental tasks of infancy is to form attachments to caregivers. Attachment relationships with the primary caregivers, most often studied as the relationship with the mother, are theorized to be an important organizational force in emotional development (Ainsworth, Blehar, Waters, & Wall, 1977; Sroufe & Waters, 1977) and are also linked to anxiety problems. Emotion regulation, especially as it relates to the modulation of expressions of negative affect, has been theorized to emerge out of the patterns of behaviors infants develop from the history experienced with the caregiver (Cassidy, 1994).

According to attachment theory, secure infant-caregiver attachment reflects a history of caregiver responsiveness to the infant's distress (Cassidy, 1994). The infant has learned that the caregiver will reliably respond to and comfort them when displaying distress. From this consistent response of external regulation, secure attachment results in the infant learning to express emotion freely and flexibly, and eventually regulate emotion more independently. As empirical support for this theory, maternal report of secure attachment has been linked to toddlers' adaptive displays of emotion and the use of mother-focused regulation (mother-directed looks, vocalizations, and proximity-seeking), the latter of which was related to decreased negative affect (Smith, Calkins, & Keane, 2006). Importantly for anxiety development, this decrease in negative affect seemed specific to fear-eliciting situations, as it did not occur in frustration-eliciting tasks.

The insecure patterns of attachment suggest disruption in this process. Insecure-avoidant relationships manifest as the infant turning attention away from the caregiver after she returns from a separation. This pattern is theorized to reflect a history of the infant receiving negative reactions from the caregiver when expressing distress (Cassidy, 1994). To prevent rejection and maintain maximal proximity to the caregiver, the infant dampens emotional expressions and other signals to the caregiver that would demand a response. Insecure-resistant (also, insecure-ambivalent or insecure-anxious) relationships are thought to develop from a pattern of inconsistent responses from the caregiver. The infant has learned to heighten expressions of distress to maximize the probability that the caregiver will respond (Cassidy, 1994). Upon reunion with the caregiver after a separation, the infant displays clear signals of wanting proximity and contact with the caregiver but also expresses high levels of distress, often in the form of anger, toward the caregiver.

In the case of disorganized attachment, there is a breakdown of these organized patterns of behavior because of extreme behavior on the part of the caregiver, usually described as "frightened or frightening" (Main & Hesse, 1990). This includes (but is not limited to) maltreating, dissociative, and disorganized (e.g., role-reversal), and simultaneously insensitive and intrusive parent behavior. The infant becomes disorganized, showing contradictory, frightened, or odd behaviors because the caregiver should be the source of comfort but is also the source of fear and distress. However, only a subset of infants in disorganized relationships explicitly display fear and apprehension, and these infants seem to be at risk for future maladaptation because of caregiver behavior (Padrón, Carlson, & Sroufe, 2014). Infants in disorganized attachment relationships who do not exhibit fear may have had existing emotion regulation difficulties present during the perinatal and newborn period that predict maladaptation.

Security in attachment relationships may protect against anxiety, while insecure, avoidant, and disorganized attachment relationships have been linked to anxiety problems. Insecure-resistant attachment has been theorized to be most predictive of anxiety because of the pattern of vigilance associated with the developing internal working model of relationships. Resistant attachment has been found to predict symptoms of school phobia, social phobia, and separation anxiety, as well as a higher number of anxiety disorders, compared to secure attachment (Bar-Haim, Lamy,

Pergamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007; Brumariu & Kerns, 2010; Warren, Huston, Egeland, & Sroufe, 1997). Dallaire and Weinraub (2005) found that attachment insecurity in infancy predicted separation anxiety at age 6, such that children in insecure-resistant relationships showed marginally more separation anxiety than children in secure relationships, but that children in insecure-resistant relationships did not significantly differ from children insecure-avoidant relationships, suggesting that these two types of insecurity may not function as differently as previously hypothesized. Further challenging a simple relation between insecure-resistant attachment and anxiety are results from meta-analyses finding that avoidant, rather than resistant, insecurity had a small but significant relation to internalizing problems (Groh, Roisman, van IJzendoorn, Bakermans-Kranenburg, & Fearon, 2012; Madigan, Atkinson, Laurin, & Benoit, 2013). When each aspect of attachment (security, resistance, avoidance, and disorganization) was measured on continuous scales, security was found to relate to lower anxiety, but the other scales had no relation (Brumariu & Kerns, 2013). Other findings suggest that attachment security, as compared to temperament, may not be as strong of a predictor of anxiety and internalizing problems (Brumariu & Kerns, 2013; Groh et al., 2012). Disorganized attachment has been less frequently studied in relation to anxiety, specifically, but there is some indication that it relates to shyness, social anxiety, school phobia, separation anxiety, and anxiety broadly (Borelli, David, Crowley, & Mayes, 2010; Brumariu & Kerns, 2010, 2013; Goodman, Stroh, & Valdez, 2012). Disorganized attachment is associated with symptoms of post-traumatic stress disorder (PTSD; Enlow, Egeland, Carlson, Blood, & Wright, 2014; MacDonald et al., 2008), which has both overlapping and distinct features in relation to other types of anxiety.

The quality of the attachment relationship has also been linked to specific emotion regulation strategies. Not surprisingly, quality of attachment relates to strategies focused on the caregiver. Infants in secure relationships have been found to use more positive social engagement than infants in insecure relationships, whereas infants in insecure-resistant relationships used more strategies of negative social engagement (particularly negative vocalizations; Crugnola et al., 2011). Infants in insecure relationships have also been shown to show less object orientation and less self-comforting than infants in secure relationships, as well as psychobiological indicators of dysregulation (Braungart & Stifter, 1991; Crugnola et al., 2011; Diener, Mangelsdorf, McHale, & Frosch, 2002; Spangler & Schieche, 1998). Interestingly, insecure-resistant infants were found to engage in less self-talk compared to other infants, which may be an early indication of deficits in cognitively based regulation seen in anxious children and adolescents (Crugnola et al., 2011). Insecure attachment may disrupt emotion regulation because of other fundamental emotion processes, such as emotion understanding (De Rosnay & Harris, 2002). In summary, secure infants use the caregiver in a healthy way to further their own regulation. Resistant infants maximize focus on the caregiver and minimize focus on exploration, reflecting vigilance and withdrawal from the environment, both of which are prominent in anxious youth. Infants in insecure-avoidant relationships use the environment to distract themselves, inhibiting emotion expression. So, both of these types of insecure infants display maladaptive forms of emotion expression. Emotional awareness and general capacities to manage intense emotions have been found to mediate the relation between attachment security assessed in middle childhood and anxiety (Brumariu & Kerns, 2013; Brumariu, Kerns, & Seibert, 2012). The relation of specific emotion regulation behaviors (e.g., ineffective or negative caregiver-focused regulation, less self-soothing, less self-talk) emerging from the attachment relationship to later anxiety problems has not yet been determined, so this remains a needed area of research.

Both fearful temperament and insecure attachment involve disrupted emotion expression and patterns of withdrawal and disengagement as regulatory strategies, despite being different in their origin (intrapersonal versus interpersonal). This may reflect the principle of equifinality

(Cicchetti & Rogosch, 1996), such that different starting points lead to the same outcome, anxiety. Further, given these similarities, it is not surprising that the combination of these features predict anxiety, both additively (and uniquely) as well as interactively (Brumariu & Kerns, 2010; Lewis-Morrarty et al., 2015; Muris & Meesters, 2002; Shamir-Essakow, Ungerer, & Rapee, 2005).

Moderators and Mediators

The relations between features of emotion development and clinically significant anxiety and between early emotion development and anxiety are complex, and it is necessary to consider additional individual characteristics and environmental factors that may set boundaries or explain mechanisms underlying them. Although an exhaustive review is beyond the scope of this chapter (see Bosquet & Egeland, 2006; Hastings et al., 2015; and McClure & Pine, 2006, for examples of developmentally based models of anxiety development), we identify key moderators and mediators identified in both, which therefore link the clinical and developmental literatures.

Gender

Although gender differences in the prevalence of anxiety disorders in childhood are usually found to be small or non-existent, a pronounced gender difference emerges in adolescence and continues into adulthood, with girls and women diagnosed at a much higher rate than boys and men (Bosquet & Egeland, 2006; Roza, Hofstra, van der Ende, & Verhulst, 2003). Children's gender may also serve as a significant moderator of the relation between aspects of emotion development and the presentation of anxiety symptoms, and the mechanisms of these differences may occur early in development.

In clinically anxious samples, girls generally report more anxiety symptoms than boys (Lewinsohn, Gotlib, Lewinsohn, Seeley, & Allen, 1998), particularly in older samples of adolescents relative to younger samples of children (Jacques & Mash, 2004). Further, adolescent girls report more negative affect than boys (Jacques & Mash, 2004). More investigations have focused on gender differences in emotion regulation capabilities across childhood. Girls have been found to report less capability in regulating the anxiety they experience (Bender et al., 2012; Neumann, van Lier, Gratz, & Koot, 2010; Suveg & Zeman, 2004), suggesting that emotion regulation strategy use may also differ between males and females. Indeed, girls' anxiety has been associated with a lack of effective emotion regulation strategies and a general lack of clarity regarding emotions (Bender et al., 2012). Boys' anxiety, on the other hand, was predicted by their non-acceptance of negative emotions. Despite some evidence that girls may experience less emotional awareness than boys (Bender et al., 2012; Hatzenbuehler, McLaughlin, & Nolen-Hoeksema, 2008), meta-analytic results reveal that gender differences are not significant (Sendzik et al., 2017). It is therefore important to further understand emotion regulation differences among males and females when characterizing anxiety in youth.

There is also theory and evidence from the developmental literature that gender may determine whether features of emotion development predict risk for anxiety problems. There may not be main effect differences in emotion reactivity when measured as negative affectivity broadly, but there appears to be a small gender difference specific to fear reactivity and fearful temperament favoring girls (Else-Quest, Hyde, Goldsmith, & Can Hulle, 2006; Hirshfeld-Becker et al., 2007; Kagan, 1998; Shamir-Essakow et al., 2005; Silverman, La Greca, & Wasserstein, 1995). It has been theorized that early maturation in emotion and verbal abilities, in combination with socialization that shapes girls toward submissive and compliant responses and away from exploration and risk-taking, may influence early vulnerabilities to manifest into internalizing problems such as anxiety (Crick & Zahn-Waxler, 2003; Keenan & Shaw, 1997; Zahn-Waxler, Klimes-Dougan, & Slattery, 2000).

Few studies have examined the extent to which gender moderates the relation between

attachment quality and anxiety risk, and existing studies provide mixed results. Smith et al. (2006) found that mother-reported attachment security related to toddlers' lower negative emotion during fear episodes, where fearful temperament would likely play a role in behavior, but only for girls. Bar-Haim et al. (2007) found that insecure-ambivalent attachment only predicted social anxiety symptoms for boys, and Brumariu and Kerns (2010) found that the relation between insecure-resistant attachment and separation anxiety was stronger for boys. These studies differed in their assessment of attachment (parent-reported, dimensional, versus observed, categorical) as well as whether they measured risk for anxiety in the form of negative affect or anxiety symptoms themselves, which may at least partially explain discrepant findings.

Gender differences have also emerged in specific emotion regulatory behaviors that may have implications for anxiety development. Recall that caregiver-focused regulatory behavior seems to emerge from secure relationships, at least when it is moderate in nature and balanced with exploration of the environment. Distress in fear-eliciting episodes has been found to be related to caregiver-focused regulatory behavior in girls but not boys (Smith et al., 2006), but also in boys but not girls, despite greater caregiver-focused behavior in girls, generally, in fear-eliciting episodes (Buss, Brooker, & Leuty, 2008). Thus, it remains unclear whether girls or boys use caregiver-focused regulation more contingently with their anxiety-relevant distress. It has also been found that in later infancy, girls may show sensitivity to disruption in the attachment relationship, measured as maternal bonding, which may be manifested in a lower rate of self-comforting regulatory behaviors (Müller et al., 2016). If insecure-resistant attachment predicts lower self-comforting behaviors in girls, and insecure-resistant attachment generally confers risk for anxiety, perhaps lower self-comforting explains a mechanism of anxiety development. It is worth mentioning again that these specific (caregiver-focused and self-comforting) regulatory behaviors have not themselves been directly linked to anxiety problems later in life, so further study into these relations would be warranted in the area of emotion development and anxiety.

Attention Bias and Information Processing

Biases in attention toward threat play an integral role in the development of anxiety and influence several features of emotion development. The heighted perception of intense emotional reactivity characteristic of clinically anxious youth can likely be traced to information-processing biases common in children with anxiety disorders. Such attentional biases toward threat have been linked to more intense emotion responses (Bar-Haim et al., 2007; Wilson, MacLeod, Mathews, & Rutherford, 2006) and are routinely associated with anxiety risk across childhood (Hadwin, Garner, & Perez-Olivas, 2006; Murray et al., 2009) and adulthood (Bar-Haim et al., 2007; Eysenck, Mogg, May, Richards, & Mathews, 1991; MacLeod, Mathews, & Tata, 1986). Relative to non-anxious children, those with anxiety interpret more threat from ambiguous situations (Alfano, Beidel, & Turner, 2002; Creswell, Schniering, & Rapee, 2005; Taghavi, Moradi, Neshat-Doost, Yule, & Dalgleish, 2000) and require less information to come to these faulty conclusions (Muris & van Doorn, 2003). Results from eye-tracking investigations suggest that anxious children orient to threatening stimuli more quickly and more frequently when compared to non-anxious controls (Shechner et al., 2013). These attention biases toward threat may exacerbate anxious youths' increased emotional reactivity and dysregulation, therefore serving to maintain anxious cognitions and behavioral responses over time.

Although the association between information biases and anxiety in middle to older childhood is routinely found, some research with younger populations suggests that the link may not be as consistent. Ooi, Dodd, and Walsh (2015) found that information-processing biases in preschool are not concurrently associated with preschoolers'

parent-reported anxiety symptoms. Other research suggests that information-processing biases in preschool are associated with anxiety symptoms 1 year later while controlling for baseline symptoms, though not anxiety 2 and 5 years later (Dodd, Hudson, Morris, & Wise, 2012). Additionally, kindergarten teachers rate their students as more anxious when, during preschool, students had revealed more socially wary and nervous thoughts during free-play vignettes about starting kindergarten (Pass, Arteche, Cooper, Creswell, & Murray, 2012). This evidence suggests that cognitive biases toward threat in younger samples may be relevant for the short-term development of future anxiety symptoms. Perhaps early information-processing biases are still being shaped throughout early childhood before settling into more stable levels that may underlie anxiety in middle childhood.

When examining attention biases in early childhood, considering the role of emotion development may help to clarify patterns relating to information biases prior to clinical impairment. As discussed above, fearful temperament reflects a tendency to experience anxious and wary emotional states and is sometimes, but not always, directly associated with attention biases in early childhood (Morales, Taber-Thomas, & Pérez-Edgar, 2017; Reeb-Sutherland et al., 2015). Over time, temperamentally fearful children may learn to associate their psychobiological reactions to novelty and uncertain social interactions with perceptions and interpretations of threat, which may then form the biases noted in clinically anxious children (Zahn-Waxler et al., 2000). However, the literature offers mixed evidence for a direct, unidirectional progression from fearful temperament to attention bias. Inconsistency may result from the particular tasks used (e.g., social versus non-social; LoBue & Pérez-Edgar, 2014) or because only stability across tasks, rather than a score on a single task, links to fearful temperament (Morales et al., 2017). It could also be that if fearful temperament characterizes a heterogeneous group of children in terms of risk, it would be expected that a direct relation to attention bias would be attenuated. This is supported by findings that dysregulated fear is directly linked to attention bias (Morales, Pérez-Edgar, & Buss, 2015). Very few longitudinal studies assessing the predictive relation between fearful temperament and attention bias exist. What evidence does exist suggests that attention bias toward threat may moderate the predictive association between fearful temperament and anxiety. For example, fearful temperament and attention bias have been found to interact to predict later social withdrawal, a precursor of anxiety (Morales et al., 2015; Pérez-Edgar et al., 2011). Event-related potentials (ERPs) measured during attention tasks have also been found to moderate the predictive association between fearful temperament and anxiety disorder symptoms and diagnoses (Reeb-Sutherland et al., 2009; Thai, Taber-Thomas, & Pérez-Edgar, 2016). Other work has found that fearful temperament predicts anxiety when the bias toward threat and away from positive stimuli is high or near zero, but not when there is a bias away from threat and/or toward positive stimuli (White et al., 2017).

There are clear neurobiological bases of attention and information processing that link fearful temperament and anxiety (see also Pérez-Edgar & Guyer, 2014), but the environment may play a role as well. Parents' interpretations of ambiguous situations as threatening are related to fear acquisition, child anxiety, and associated emotion regulation (Dubi, Rapee, Emerton, & Schniering, 2008; Hane & Barrios, 2011). Temperamentally fearful children may more readily internalize these messages than other children, suggesting an interaction between temperament and environmental shaping of attention biases (Field & Price-Evans, 2009). Parenting matters not only for attention bias, but also for broader aspects of the association between emotion development and anxiety.

Parenting

Emotion Socialization

One well-understood way that emotions (and their regulation) are learned is through the socialization by parents. Emotion socialization

comprises the ways in which parents talk about, model, and react to emotions (Eisenberg, Cumberland, & Spinrad, 1998; Morris, Silk, Steinberg, Myers, & Robinson, 2007). Theoretical models link emotion socialization directly to aspects of emotion development, such as emotion expressivity, emotion regulation, and emotion understanding and indirectly through emotion development to maladaptive outcomes such as anxiety (Morris et al., 2007).

Aspects of emotion socialization have been linked directly to anxiety problems in children and adolescents. Families of anxious children are less likely to engage in open communication and more likely to model avoidance and threat interpretation (Barrett, Rapee, Dadds, & Ryan, 1996; Chorpita, Albano, & Barlow, 1996). When asked to discuss a time the child experienced worry, sadness, and anger, mothers of anxious children spoke more, were less likely to use positive emotion words, and were more likely to use discouragement in response to emotion discussions than mothers of non-anxious children (Suveg, Zeman, Flannery-Schroeder, & Cassano, 2005). On average, children with anxiety indicated lower levels of family expressiveness than the mothers (Suveg et al., 2005). Fathers similarly are less expansive when discussing emotions with their anxious youth relative to fathers with non-anxious youth (Suveg et al., 2008). Gender may again play a role here, as the tone of emotion discussion with sons who were anxious was more negative for both mothers and fathers (Suveg et al., 2008). There has been at least some indication that fathers may play a larger role in the socialization of emotions for sons (Suveg et al., 2008).

Parental reactions to negative emotions have also been related to anxiety, but perhaps in varied ways. Parental emotion coaching, which involves perceiving and reacting to children's negative emotions as opportunities for building relationships and skills, has been found to be lower in parents of children with anxiety disorders compared to parents of children without anxiety disorders, and these children with anxiety disorders simultaneously showed lower emotion regulatory abilities (Hurrell, Houwing, & Hudson, 2017). In the developmental literature, supportive emotion socialization (focusing on solving the problem at hand, using strategies to alleviate the child's distress, encouraging the child's expression of emotion) related to separation anxiety through children's emotion regulation, operationalized as effortful control (Spinrad et al., 2007). Others have found no direct relation or a negative relation between unsupportive (punitive/minimizing) emotion socialization and anxiety (Suveg, Shaffer, Morelen, & Thomassin, 2011). Emotion socialization may also serve as a moderator. Suveg et al. (2005) found that children's emotion regulation difficulties only related to anxiety in the context of low punitive/minimizing reactions. Further, interpretation biases that arise from aspects of emotion development, as discussed above, may relate to anxiety problems differently depending on emotion socialization. Viana, Dixon, Stevens, and Ebesutani (2016) found that interpretation biases related to higher anxiety in the context of low unsupportive responses and lower anxiety in the context of higher levels of unsupportive responses. Further, effects may vary by age, with supportive emotion socialization being appropriate and related to lower anxiety in younger children, but interfering with autonomy and therefore related to higher anxiety in older children (Mirabile, Oertwig, & Halberstadt, 2018). Even though the study of the role of emotion socialization in the relation between emotion development and anxiety outcomes has only recently gained momentum, it is clear that this is a much needed area for future study.

Overcontrolling Behaviors

Parents' engagement in overcontrol, either through overprotection or intrusiveness, also plays a role in aspects of emotion development apparent in children with anxiety disorders, as well as in features of emotion development happening earlier in life. Whether parents limit children's interactions with new situations or people, as in the case of overprotection, or push them into these situations with too much force, as is the case for intrusiveness, overcontrol is theorized to both increase emotion reactivity and limit children's abilities to practice independent

emotion regulation, which subsequently puts them at risk for anxiety (Chorpita & Barlow, 1998). Overcontrol is consistently linked to anxiety symptoms and disorders, as well as its developmental precursors, such as shyness and social withdrawal (Bayer, Sanson, & Hemphill, 2006; Edwards, Rapee, & Kennedy, 2010; Kiel & Buss, 2011; Laurin, Joussemet, Tremblay, & Boivin, 2015; Lewis-Morrarty et al., 2012; Rubin, Coplan, & Bowker, 2009). But what role does overcontrol play specifically in terms of emotion development? For children at risk for anxiety due to having an anxious mother, maternal overcontrol related to increased reactivity (Borelli, Burkhardt, Rasmussen, Smiley, & Hellemann, 2018). Maternal overprotection has also been found to relate to the maintenance of toddlers' distress across the course of a fear-eliciting laboratory task, which could suggest that protective behavior interfered with children's emotion regulation (Buss & Kiel, 2010). Further, in adult samples, retrospective reports of overprotection have been linked to maladaptive forms of emotion regulation (e.g., rumination, experiential avoidance), which may then mediate the relation between overprotective parenting and anxiety (Fulton, Kiel, Tull, & Gratz, 2014; Ingram, Bailey, & Siegle, 2004; Manfredi et al., 2011). Prospective studies assessing these relations in children and adolescents over the course of development are needed for stronger evidence of this relation.

Another ongoing need is to clarify the specific role of overcontrol in children's emotional development and subsequent anxiety. Overcontrolling parenting has been studied as both a moderator and a mediator of children's developmental outcomes, including anxiety. Transactional models suggest that children actively contribute to the caregiving they receive, so relations between children's emotional development and parenting are likely bidirectional (Dadds & Roth, 2001). Indeed, fearful temperament and dysregulated fear are related to children's success in eliciting protective responses (Kiel & Buss, 2011, 2012, 2014). Chorpita and Barlow's (1998) model of overcontrol and its relation to child anxiety suggests that an overcontrolling caregiving environment may function as a mediator early in development and then shift to a moderator as children become older. Undoubtedly, it is difficult to parse apart child-driven and parent-driven aspects of this process.

Parent Factors

From the research reviewed above, it is clear that parenting is a strong environmental influence on child anxiety development. The tendency to engage in these anxiety-promoting parenting behaviors, however, can also be impacted by parents' own anxiety. Anxious parents are generally more disengaged (Woodruff-Borden, Morrow, Bourland, & Cambron, 2002) and less sensitive (Nicol-Harper, Harvey, & Stein, 2007) and may also be less appropriately supportive during the socialization of negative emotions (Creswell, Apetroaia, Murray, & Cooper, 2013). Anxious parents report more concern when their children engage in novel, yet developmentally appropriate activities (Turner, Beidel, Roberson-Nay, & Tervo, 2003), perhaps suggesting that they may be less likely to encourage autonomy. Although some research supports this assertion that anxious parents are more controlling and less likely to encourage independence (Bögels & van Melick, 2004; Borelli, Margolin, & Rasmussen, 2015), results from a meta-analysis suggest this link may be strongest for anxious parents of boys and school age children (van der Bruggen, Stams, & Bögels, 2008). It is possible that non-significant direct associations between parental anxiety and control occur because this relation is actually curvilinear. Indeed, van der Bruggen, Bögels, and van Zeilst (2010) found that anxious mothers are more likely to engage in both more and less overcontrol, with average rates of overcontrol for mothers low in trait anxiety. Authors speculated that this is likely driven by an anxious mother's desire to avoid unpredictability or in an effort to regulate her own anxious distress, respectively. Additional research suggests that anxiety-relevant parenting behaviors may differ between anxious mothers and fathers (Teetsel, Ginsburg, & Drake, 2014) and that one parent's anxiety may

impact the other parent's behavior to influence child anxiety development (Gibler, Kalomiris, & Kiel, 2018). From these findings, it is clear that parental anxiety can certainly broadly impact the parenting behaviors that a child receives.

Parental influence on child anxiety development is not limited to these environmental factors, but can also be linked to shared genetic material. Twin and family studies suggest that anxiety disorders cluster within families (Biederman et al., 2001; Black, Gaffney, Schlosser, & Gabel, 2003; Eley et al., 2003; Merikangas, Lieb, Wittchen, & Avenevoli, 2003), with 39–64% of disorder-specific anxiety accounted for by genetics (Eley et al., 2003). Meta-analytic results reveal that offspring of parents with anxiety are at nearly a fourfold increased risk for developing any anxiety disorder when compared to offspring of non-psychiatric parental controls (Micco et al., 2009). Given that these genetic underpinnings account for a substantial amount of variance in parent-child anxiety transmission, the role of genetics in the development and maintenance of anxiety should not be overlooked.

Overall, therefore, parenting appears to play a role in aspects of emotion development that relate to both anxiety disorders as well as anxiety risk. There is ample room for future work in this area. Studies are needed that use prospective, longitudinal assessments of parenting and parent anxiety, emotion development, and anxiety outcomes, and that can address the bidirectional effects known to occur between anxious children and their parents. Further, it is essential to consider the context in which parenting is provided. For example, overcontrol has typically been studied in low-risk environments characterized by a minimal level of objective threat. Overcontrol may function quite differently, and be quite adaptive for children's outcomes, in at-risk contexts containing real threats to children's development. Therefore, considering multiple aspects of the cultural context of parenting, in addition to broader cultural influences on the relation between emotion development and anxiety, is critical.

Culture and Context

No discussion of development would be complete without acknowledging the role of culture and contextual variables. Although we cannot do justice to the pervasive role that culture has in development, there are a few ways in which it has been studied specifically in relation to children's emotion development and anxiety outcomes.

Aspects of emotion development may manifest differently in different cultures. Both the prevalence of fearful temperament and the proportions of the different attachment classifications, for example, appear to differ across cultures (Chen et al., 1998; van Ijzendoorn & Sagi-Schwartz, 2008), which may have implications for the extent to which they are considered deviations from typical emotion development and subsequently predict anxiety. The pathway to normal or atypical emotion development from these constructs would heavily depend on children's interactions within those cultures. Culture encompasses societal beliefs about the nature and expression of emotions, and these beliefs emerge in environmental influences on children's internal experiences and external behavior. This is especially evident in parents' roles in emotion development and subsequent anxiety. The withdrawn behavior demonstrated by temperamentally fearful children, for example, may cause distress to many parents in Western cultures that prioritize values of independence, but be considered respectful and more typical in Eastern cultures that value interdependence (Chen, 2010; Rubin et al., 2006). However, independence and interdependence are not mutually exclusive, and variation in each of these exists within cultures and across time (Greenfield, Keller, Fuligni, & Maynard, 2003). During the course of modernization in urban areas of China, for example, independence and assertiveness have become increasingly valued, and the perception of fearful temperament may have shifted to be more negative in turn (Coplan et al., 2016). Further, cultural differences in general emotion socialization practices (Daga, Raval, & Raj, 2015; Raval, Raval, Salvina, Wilson, & Writer, 2013) would also

have implications for anxiety development. Socialization practices that are considered to be maladaptive in one culture may be more normative in another, influencing how children perceive and respond to them (McCord & Raval, 2016). It is prudent not to oversimplify differences between cultures (e.g., independence versus interdependence; Perez & Gauvain, 2007), as there is more variance in some of these constructs within a given culture than across cultures, but cultural influence pervades emotion development and should be considered an ever-present contextual influence on its relation to anxiety.

Additional environmental variables may contextualize the extent to which emotion development intersects with anxiety development. Poverty and related neighborhood characteristics, particularly exposure to violent crimes, may directly predict anxiety, trauma symptoms, and related outcomes (Chronis-Tuscano, Danko, Rubin, Coplan, & Novick, 2018; Cooper-Vince, Chan, Pincus, & Comer, 2014). Whether this has a stronger effect on anxiety for children experiencing aspects of emotion development such as fearful temperament or insecure attachment, or even broader consequences for emotion development, remains unknown. Neighborhood characteristics may also have a direct effect on parenting, with poverty and social disorganization shown to influence parents to be more isolative and controlling of their children (Furstenberg et al., 1993, as cited in Belsky & Jaffee, 2006). For children at risk for anxiety development because of dispositional emotion processes, isolation and heightened control could prevent autonomy and increase the likelihood of anxiety outcomes. On the other hand, in neighborhoods characterized by high rates of crime, particularly violent crime, controlling parenting behavior may not be considered *over*control because it is a necessary behavior to keep children safe. Increased parental control that limits exposure to violence could therefore lead to decreased risk for anxiety. Socioeconomic disadvantage may also affect parenting more indirectly, as it increases parental anxiety and distress (Cooklin et al., 2014). These environmental influences may interact, such that neighborhood characteristics may determine the extent to which parenting relates to children's anxiety development, or parenting may determine the influence of the neighborhood on anxiety outcomes. For example, while paternal autonomy restriction was found to predict children's anxiety in families living in safe neighborhoods, it was not found to relate to increased anxiety in families living in less safe neighborhoods (Cooper-Vince et al., 2014). Further, whereas high parental warmth may be relevant for relations between temperament and anxiety for children in middle-class, European and European American samples (Kiel & Buss, 2011; Mount, Crockenberg, Bárrig Jó, & Wagar, 2010; Rubin, Hastings, Stewart, Henderson, & Chen, 1997; van der Bruggen, Stams, Bögels, & Paulussen-Hoogeboom, 2010), when children perceived their neighborhoods to be more dangerous, high levels of warmth related to lower levels of internalizing problems like anxiety (Goldner et al., 2016). Integration of these results suggests that neighborhood climate, safety concerns, and socioeconomic disadvantage may change the influences on and consequences of parenting behaviors found to be relevant in primarily middle-class European/European American samples. No study to date, however, has examined all of these variables within an emotion development framework with young children (Chronis-Tuscano et al., 2018), which will be an important future direction for this literature.

Incorporating Emotion Development into Treatment

Given that emotion reactivity, regulation, understanding, and competence are related to both anxiety disorders and developmental processes of risk, it is important that emotion development be incorporated into the treatment and prevention of anxiety. There are several ways in which this is already occurring.

In treating existing youth anxiety disorders, the most empirically supported approach is cognitive-behavioral therapy (CBT), which targets both maladaptive cognitions and avoidance

of anxiety-provoking situations and experiences (Kendall, Hudson, Choudhury, Webb, & Pimental, 2005; Ollendick, King, & Chorpita, 2006; Pincus, Ehrenreich-May, Whitton, Mattis, & Barlow, 2010). To target maladaptive cognitions, the primary strategy is cognitive restructuring, which guides the child to realize the low probability of catastrophic outcomes, the high probability of successful coping with more moderately negative outcomes, and alternative interpretations of ambiguous situations that attention biases may cause her or him to interpret negatively. Children also learn problem-solving strategies and relaxation techniques, which they may use when doing exposure exercises to combat behavioral avoidance. In addition to treating the core features of anxiety, CBT has been found to increase children's emotion awareness, generally, and emotion regulation specific to worry (Suveg, Sood, Comer, & Kendall, 2009). CBT for anxiety typically contains some psychoeducation about emotion; other components, such as relaxation, may facilitate emotion regulation (Hannesdottir & Ollendick, 2007). Cognitive restructuring, specifically, has been likened to the emotion regulation strategy of reappraisal (Hannesdottir & Ollendick, 2007; Klumpp et al., 2017). In adults, CBT has been shown to affect neural structures implicated in emotion reactivity and regulation (Goldin et al., 2014; Klumpp et al., 2017).

Although CBT is generally effective, up to one-third children undergoing this treatment do not display improvements in their symptoms, or they fail to maintain treatment gains (Kendall, Hudson, Choudhury, Webb, & Pimentel, 2005; Ollendick et al., 2006), potentially because the intersection between emotion development and anxiety had not been fully incorporated (Hannesdottir & Ollendick, 2007). Emotion-focused CBT (ECBT) is a modification to traditional CBT that more directly addresses emotion regulation and understanding (Kendall & Suveg, 2005). Importantly, ECBT addresses potential deficits in emotion development, broadly, rather than only those relevant to anxiety-inducing situations. Skill-building in emotion understanding is integrated throughout treatment, and children expand their repertoire of regulation strategies for a variety of emotions, including anger, sadness, and guilt. Exposure tasks occurring in the later part of treatment also incorporate practice in emotion regulation. ECBT has been shown to result in increased emotion awareness and understanding, less frequent negative affect, and more appropriate emotion regulation, in addition to the expected decrease in anxiety symptomatology and its impact on global functioning (Suveg, Kendall, Comer, & Robin, 2006).

The Unified Protocol for the Treatment of Emotional Disorders in Adolescence (Ehrenreich, Goldstein, Wright, & Barlow, 2009) and its adaptation for group treatment of younger children, the Unified Protocol for the Treatment of Emotional Disorders in Children: Emotion Detectives (Ehrenreich-May & Bilek, 2012) were also developed out of emotion science and developmental psychopathology theory. These treatments integrate emotion identification and understanding, broadening of emotion vocabulary, and emotion regulation skills such as reappraisal and acceptance. Evidence is accumulating for the effectiveness of these interventions in reducing anxiety symptoms (Bilek & Ehrenreich-May, 2012), although outcomes specifically related to emotion development have not yet been investigated.

Given that early childhood may represent a sensitive period for many aspects of emotion development, including emotion awareness and emotion regulation, prevention programs are particularly suited to this developmental period. Further, leveraging aspects of emotional development related to later anxiety, such as fearful temperament, may target fundamental processes that steer some children toward maladaptation. Rapee, Kennedy, Ingram, Edwards, and Sweeney (2005) investigated whether a parent psychoeducation-based prevention program geared toward parents of inhibited preschoolers would result in decreased incidence of anxiety diagnoses. Although participation in the program did not alter children's fearful temperament, it did predict decreased incidence of anxiety disorders 12 months (Rapee et al., 2005) and 3 years later (Rapee, Kennedy, Ingram, Edwards, &

Sweeney, 2010). Another prevention program aimed at preschoolers and their parents, the Turtle Program from Chronis-Tuscano et al. (2015), also addresses parenting and social skills relevant to temperamentally fearful children. This program resulted in decreased anxiety symptoms and parent-reported fearful temperament.

The existence of these emotion-based interventions suggests an increased recognition of the importance of emotion development for the onset, maintenance, and amelioration of anxiety problems throughout development. However, there are clear future directions for the further incorporation of emotion development into anxiety treatment. It is not clear whether targeting maladaptive deviations in emotion development specifically helps the children and adolescents who would not respond to traditional CBT. Perhaps combining features of treatment and prevention, such as targeting temperamentally fearful children and their families for prevention and using emotion-based skills relevant to the child's developmental period (e.g., emotion recognition and labeling in preschoolers), would enhance results (Izard et al., 2002). Furthermore, in line with the developmental psychopathology perspective, these interventions could be leveraged to further our understanding of emotion development (Hudson, Kendall, Coles, Robin, & Webb, 2002). Outside of follow-up assessments of maintenance of treatment gains, it will also be important to understand whether broader emotion development veers back toward typical trajectories for these youth. If it does, this will augment evidence for causal relations between individual differences in emotion development and the development of anxiety and underscore the malleability of developmental trajectories. Intervention development may result in reflections on typical emotional development. The fact that children could not articulate certain emotional concepts as well as adolescents both influenced the development of Emotion Detectives (Ehrenreich-May & Bilek, 2012) and resulted in knowledge to contribute about children's general emotion development. Intervention studies may also increase the knowledge base about moderators and mediators of the relation between emotion development and anxiety. For example, gender differences in treatment response may dovetail with findings from the developmental literature about differential effects of etiological factors on emotion outcomes in male and female children (Hudson et al., 2002). The fields of clinical and developmental psychology would mutually benefit from the reciprocal knowledge generated between emotion development and intervention research.

Conclusion

Emotion development theory and research make a substantial contribution to the field's understanding of anxiety problems in children, adolescents, and adults. Anxiety disorders relate to heightened emotion reactivity, difficulties with emotion regulation (both global dysregulation and use of maladaptive strategies), and deficits in emotion understanding and competence across measurement modalities. Important future directions for the study of emotion processes in youth with anxiety disorders include developing clarity and precision in how flexibility in emotion regulation is observed and then determining how it differs between children with versus without anxiety disorders, as well as identifying profiles of specific strategy use that characterize children and adolescents with clinically relevant anxiety.

Individual differences in characteristics and processes of emotion development, such as fearful temperament and attachment, may provide insight into the sources of these difficulties at the behavioral, cognitive, and psychophysiological levels. In the area of temperament, dysregulated fear has shown promise as a more specific predictor of anxiety, but it is a relatively newly studied construct. Future work is needed to understand its phenomenology and role in anxiety development. Another future direction in this area is understanding how the emotion regulation strategies observed in relation to fearful temperament and insecure attachment relate to later anxiety. Perhaps these early manifestations of emotion regulation provide a mechanism linking more organizational frameworks of

emotion development (temperament, attachment) to anxiety outcomes.

A number of moderators and mediators help us understand the role of emotion development in anxiety problems. Gender may determine how emotion development is experienced and how it relates to anxiety, although this literature remains mixed. Future work could clarify how gender differences in emotion regulation relate to gender differences in anxiety, specifically, and how to interpret discrepant findings more generally. Attention biases represent another individual characteristic that link emotion development with anxiety, but few prospective longitudinal studies that integrate these fields exist. Similarly, although emotion socialization and overcontrolling parenting behaviors have known links to anxiety, studying them longitudinally in relation to both development and specific anxiety outcomes would clarify their role. It will be important for future work to identify contexts and combinations of responses that determine when emotion socialization predicts anxiety. Further, overcontrolling parenting needs to be studied across different cultural contexts and while considering additional environmental variables such as poverty, neighborhood safety, and trauma. As a broad future direction, this literature requires studies that assess multiple levels of influence, explicitly considering culture and context.

Finally, emotion processes are beginning to be incorporated into early intervention and treatment of anxiety problems, and findings are promising in suggesting that increased attention to emotion reactivity, regulation, and understanding may result in decreased anxiety. It will be important for future studies to assess outcomes related to emotion development to understand the transactional nature between emotion processes and anxiety. Continuing to use emotion development as a framework for studying anxiety onset, maintenance, and remittance will aid not only in the identification of at-risk children early in development but also inform interventions that are developmentally sensitive and focused on getting children back on track toward adaptive developmental trajectories.

References

Ainsworth, M., Blehar, M., Waters, E., & Wall, S. (1977). *Patterns of attachment: Observations in the strange situation and at home*. Hillsdale, NJ: Erlbaum.

Aldao, A., Nolen-Hoeksma, S., & Schweizer, S. (2010). Emotion regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review, 30*, 217–237.

Alfano, C. A., Beidel, D. C., & Turner, S. M. (2002). Cognition in childhood anxiety: Conceptual, methodological, and developmental issues. *Clinical Psychology Review, 22*, 1209–1238.

Badanes, L. S., Watamura, S. E., & Hankin, B. L. (2011). Hypocortisolism as a potential marker of allostatic load in children: Associations with family risk and internalizing disorders. *Development and Psychopathology, 23*, 881–896.

Bar-Haim, Y., Lamy, D., Pergamin, L., Bakermans-Kranenburg, M. J., & van Ijzendoorn, M. H. (2007). Threat-related attentional bias in anxious and nonanxious individuals: A meta-analytic study. *Psychological Bulletin, 133*, 1–24.

Barrett, P. M., Rapee, R. M., Dadds, M. M., & Ryan, S. M. (1996). Family enhancement of cognitive style in anxious and aggressive children. *Journal of Abnormal Child Psychology, 24*, 187–203.

Barrett, P., & Turner, C. (2001). Prevention of anxiety symptoms in primary school children: Preliminary results from a universal school-based trial. *British Journal of Clinical Psychology, 40*, 399–410.

Bayer, J. K., Sanson, A. V., & Hemphill, S. A. (2006). Parent influences on early childhood internalizing difficulties. *Journal of Applied Developmental Psychology, 27*, 542–559.

Belsky, J., & Jaffee, S. R. (2006). The multiple determinants of parenting. In D. Cicchetti & D. J. Cohen (Eds.), *Developmental psychopathology (Vol 3): Risk, disorder, and adaption* (2nd ed., pp. 38–85). Hoboken, NJ: John Wiley & Sons.

Beesdo, K., Lau, J. Y., Guyer, A. E., McClure-Tone, E. B., Monk, C. S., Nelson, E. E., … Ernst, M. (2009). Common and distinct amygdala-function perturbations in depressed vs anxious adolescents. *Archives of General Psychiatry, 66*, 275–285.

Bender, P. K., Pons, F., Harris, P. L., Esbjørn, B. H., & Reinholdt-Dunne, M. L. (2015). Emotion understanding in clinically anxious children: A preliminary investigation. *Frontiers in Psychology, 6*, 1–10.

Bender, P. K., Reinholdt-Dunne, M. L., Esbjørn, B. H., & Pons, F. (2012). Emotion dysregulation and anxiety in children and adolescents: Gender differences. *Personality and Individual Differences, 53*(3), 284–288.

Biederman, J., Faraone, S. V., Hirshfeld-Becker, D. R., Friedman, D., Robin, J. A., & Rosenbaum, J. F. (2001). Patterns of psychopathology and dysfunction in high-risk children of parents with panic disorder and major depression. *American Journal of Psychiatry, 158*(1), 49–57.

Biederman, J., Rosenbaum, J. F., Bolduc-Murphy, E. A., Faraone, S. V., Chaloff, J., Hirshfeld, D., & Kagan, J. (1993). A 3-year follow-up of children with and without behavioral inhibition. *Journal of the American Academy of Child & Adolescent Psychiatry, 32*, 814–821.

Bilek, E. L., & Ehrenreich-May, J. (2012). An open trial investigation of a transdiagnostic group treatment for children with anxiety and depressive symptoms. *Behavior Therapy, 43*, 887–897.

Bittner, A., Egger, H. L., Erkanli, A., Costello, J. E., Foley, D. L., & Angold, A. (2007). What do childhood anxiety disorders predict? *Journal of Child Psychology and Psychiatry, 48*, 1174–1183.

Black, D. W., Gaffney, G. R., Schlosser, S., & Gabel, J. (2003). Children of parents with obsessive-compulsive disorder—A 2-year follow-up study. *Acta Psychiatrica Scandinavia, 107*(4), 305–313.

Bögels, S. M., & van Melick, M. (2004). The relationship between child-report, parent self-report, and partner report of perceived parental rearing behaviors and anxiety in children and parents. *Personality and Individual Differences, 37*(8), 1583–1596.

Borelli, J. L., Burkhardt, M. L., Rasmussen, H. F., Smiley, P. A., & Hellemann, G. (2018). Children's and mothers' cardiovascular reactivity to a standardized laboratory stressor: Unique relations with maternal anxiety and overcontrol. *Emotion, 18*(3), 369–385.

Borelli, J. L., David, D. H., Crowley, M. L., & Mayes, L. C. (2010). Links between disorganized attachment classification and clinical symptoms in school-aged children. *Journal of Child and Family Studies, 19*, 243–256.

Borelli, J. L., Margolin, G., & Rasmussen, H. F. (2015). Parental overcontrol as a mechanism explaining the longitudinal association between parent and child anxiety. *Journal of Child and Family Studies, 24*(6), 1559–1574.

Bosquet, M., & Egeland, B. (2006). The development and maintenance of anxiety symptoms from infancy through adolescence in a longitudinal sample. *Development and Psychopathology, 18*, 517–550.

Boyle, A. M., & O'Sullivan, L. F. (2013). The influence of dating anxiety on normative experiences of dating, sexual interactions, and alcohol consumption among Canadian middle adolescents. *Journal of Youth Studies, 16*, 222–236.

Braungart, J. M., & Stifter, C. A. (1991). Regulation of negative reactivity during the strange situation: Temperament and attachment in 12-month-old infants. *Infant Behavior and Development, 14*(3), 349–364.

Bress, J. N., Meyer, A., & Hajcak, G. (2015). Differentiating anxiety and depression in children and adolescents: Evidence from event-related brain potentials. *Journal of Clinical Child & Adolescent Psychology, 44*, 238–249.

Brooker, R. J., Kiel, E. J., & Buss, K. A. (2016). Early social fear predicts kindergarteners' socially anxious behaviors: Direct associations, moderation by inhibitory control, and differences from nonsocial fear. *Emotion, 16*, 997–1010.

Brozovich, F. A., Goldin, P., Lee, I., Jazaieri, H., Heimberg, R. G., & Gross, J. J. (2015). The effect of rumination and reappraisal on social anxiety symptoms during cognitive-behavioral therapy for social anxiety disorder. *Journal of Clinical Psychology, 71*, 208–218.

Brumariu, L. E., & Kerns, K. A. (2010). Mother-child attachment patterns and different types of anxiety symptoms: Is there specificity of relations? *Child Psychiatry and Human Development, 41*, 663–674.

Brumariu, L. E., & Kerns, K. A. (2013). Pathways to anxiety: Contributions of attachment history, temperament, peer competence, and ability to manage intense emotions. *Child Psychiatry and Human Development, 44*, 504–515.

Brumariu, L. A., Kerns, K. A., & Seibert, A. (2012). Mother-child attachment, emotion regulation, and anxiety symptoms in middle childhood. *Personal Relationships, 19*, 569–585.

Buss, K. A. (2011). Which fearful toddlers should we worry about? Context, fear regulation, and anxiety risk. *Developmental Psychology, 47*, 804–819.

Buss, K. A., Brooker, R. J., & Leuty, M. (2008). Girls most of the time, boys some of the time: Gender differences in toddlers' use of maternal proximity and comfort seeking. *Infancy, 13*, 1–29.

Buss, K. A., Davidson, R. J., Kalin, N. H., & Goldsmith, H. H. (2004). Context-specific freezing and associated physiological reactivity as a dysregulated fear response. *Developmental Psychology, 40*, 583–594.

Buss, K. A., Davis, E. L., Kiel, E. J., Brooker, R. J., Beekman, C., & Early, M. C. (2013). Dysregulated fear predicts social wariness and social anxiety symptoms during kindergarten. *Journal of Clinical Child and Adolescent Psychology, 42*, 603–616.

Buss, K. A., & Goldsmith, H. H. (2000). *Laboratory Temperament Assessment Battery (Lab-TAB) – Toddler Version*. Unpublished manual. University of Wisconsin-Madison.

Buss, K. A., & Kiel, E. J. (2010). Do maternal protective behaviors alleviate toddlers' fearful distress? *International Journal of Behavioral Development, 35*, 136–143.

Calkins, S. D., & Hill, A. (2007). Caregiver influences on emerging emotion regulation: Biological and environmental transactions in early development. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 229–248). New York, NY: Guilford Press.

Campos, J. J., Frankel, C. B., & Camras, L. (2004). On the nature of emotion regulation. *Child Development, 75*, 377–394.

Caouette, J. D., & Guyer, A. E. (2014). Gaining insight into adolescent vulnerability for social anxiety from developmental cognitive neuroscience. *Developmental Cognitive Neuroscience, 8*, 65–76.

Carthy, T., Horesh, N., Apter, A., & Gross, J. J. (2010). Patterns of emotional reactivity and regulation

in children with anxiety disorders. *Journal of Psychopathology and Behavioral Assessment, 32*(1), 23–36.

Carthy, T., Horesh, N., Apter, A., Edge, M. D., & Gross, J. J. (2010). Emotional reactivity and cognitive regulation in anxious children. *Behaviour Research and Therapy, 48*(5), 384–393.

Casey, R. J. (1996). Emotional competence in children with externalizing and internalizing disorders. In M. Lewis & M. W. Sullivan (Eds.), *Emotional development in atypical children* (pp. 161–184). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Cassidy, J. (1994). Emotion regulation: Influences of attachment relationships. *Monographs of the Society for Research in Child Development, 59*(2–3), 228–249.

Chen, X. (2010). Shyness-inhibition in childhood and adolescence: A cross-cultural perspective. In K. H. Rubin & R. J. Coplan (Eds.), *The development of shyness and social withdrawal* (pp. 213–235). New York: Guilford.

Chen, X., Hastings, P. D., Rubin, K. H., Chen, H., Cen, G., & Li, D. (1998). Child-rearing practices and behavioral inhibition in Chinese and Canadian toddlers: A cross-cultural study. *Developmental Psychology, 34*, 677–686.

Chorpita, B. F., Albano, A. M., & Barlow, D. H. (1996). Cognitive processing in children: Relation to anxiety and family influences. *Journal of Clinical Child Psychology, 25*(2), 170–176.

Chorpita, B. F., & Barlow, D. H. (1998). The development of anxiety: The role of control in the early environment. *Psychological Bulletin, 124*, 3–21.

Chronis-Tuscano, A., Danko, C. M., Rubin, K. H., Coplan, R. J., & Novick, D. R. (2018). Future directions for research on early intervention for young children at risk for social anxiety. *Journal of Clinical Child and Adolescent Psychology, 47*(4), 655–667.

Chronis-Tuscano, A., Degnan, K. A., Pine, D. S., Pérez-Edgar, K., Henderson, H. A., Diaz, Y., … Fox, N. A. (2009). Stable early maternal report of behavioral inhibition predicts lifetime social anxiety disorder in adolescence. *Journal of the American Academy of Child and Adolescent Psychiatry, 48*, 928–935.

Chronis-Tuscano, A., Rubin, K. H., O'Brien, K. A., Coplan, R. J., Thomas, S. R., Dougherty, L. A., … Wimsatt, M. (2015). Preliminary evaluation of a multimodal early intervention program for behaviorally inhibited preschoolers. *Journal of Consulting and Clinical Psychology, 83*, 534–540.

Cicchetti, D., Ackerman, B. P., & Izard, C. E. (1995). Emotions and emotion regulation in developmental psychopathology. *Development and Psychopathology, 7*, 1–10.

Cicchetti, D., & Rogosch, F. A. (1996). Equifinality and multifinality in developmental psychopathology. *Development and Psychopathology, 8*, 597–600.

Cisler, J. M., Olatunji, B. O., Feldner, M. T., & Forsyth, J. P. (2010). Emotion regulation and the anxiety disorders: An integrative review. *Journal of Psychopathology and Behavioral Assessment, 32*, 68–82.

Clark, L. A., & Watson, D. (1991). Tripartite model of anxiety and depression: Psychometric evidence and taxonomic implications. *Journal of Abnormal Psychology, 100*, 316–336.

Cole, P. M., Martin, S. E., & Dennis, T. A. (2004). Emotion regulation as a scientific construct: Methodological challenges and directions for child development research. *Child Development, 75*, 317–333.

Cole, P. M., Michel, M. K., & Teti, L. O. D. (1994). The development of emotion regulation and dysregulation: A clinical perspective. *Monographs of the Society for Research in Child Development, 59*(2–3), 73–102.

Cooklin, A. R., Lucas, N., Strazdins, L., Westupp, E., Giallo, R., & Canterford, L. (2014). Heightened maternal separation anxiety in the postpartum: The role of socioeconomic disadvantage. *Journal of Family Issues, 35*, 1497–1519.

Cooper-Vince, C. E., Chan, P. T., Pincus, D. B., & Comer, J. S. (2014). Paternal autonomy restriction, neighborhood safety, and child anxiety trajectory in community youth. *Journal of Applied Developmental Psychology, 35*, 265–272.

Coplan, R. J., Liu, J., Ooi, L. L., Chen, X., Li, D., & Ding, X. (2016). A person-oriented analysis of social withdrawal in Chinese children. *Social Development, 25*, 794–811.

Costello, E. J., Egger, H. L., & Angold, A. (2005). The developmental epidemiology of anxiety disorders: Phenomenology, prevalence, and comorbidity. *Child and Adolescent Psychiatric Clinics of North America, 14*, 631–648.

Costello, E. J., Mustillo, S., Erkanli, A., Keeler, G., & Angold, A. (2003). Prevalence and development of psychiatric disorders in childhood and adolescence. *Archives of General Psychiatry, 60*, 837–844.

Craske, M. G. (2012). Transdiagnostic treatment for anxiety and depression. *Depression and Anxiety, 29*, 749–753.

Creswell, C., Apetroaia, A., Murray, L., & Cooper, P. (2013). Cognitive, affective, and behavioral characteristics of mothers with anxiety disorders in the context of child anxiety disorder. *Journal of Abnormal Psychology, 122*(1), 26–38.

Creswell, C., Schniering, C. A., & Rapee, R. M. (2005). Threat interpretation in anxious children and their mothers: Comparison with nonclinical children and the effects of treatment. *Behaviour Research and Therapy, 43*, 1375–1381.

Crick, N. R., & Zahn-Waxler, C. (2003). The development of psychopathology in females and males: Current progress and future challenges. *Development and Psychopathology, 15*, 719–742.

Crugnola, C. R., Tambello, R., Spinelli, M., Gazzotti, S., Caprin, C., & Albizzati, A. (2011). Attachment patterns and emotion regulation strategies in the second year. *Infant Behavior and Development, 34*, 136–151.

Dadds, M. R., & Roth, J. H. (2001). Family processes in the development of anxiety problems. In M. W. Vasey & M. R. Dadds (Eds.), *The developmental psycho-*

pathology of anxiety (pp. 278–303). New York, NY: Oxford University Press.

Daga, S. S., Raval, V. V., & Raj, S. P. (2015). Maternal meta-emotion and child socioemotional functioning in immigrant Indian and White American families. *Asian American Journal of Psychology, 6*, 233–241.

Dallaire, D. H., & Weinraub, M. (2005). Predicting children's separation anxiety at age 6: The contributions of infant-mother attachment security, maternal sensitivity, and maternal separation anxiety. *Attachment and Human Development, 7*, 393–408.

De Rosnay, M., & Harris, P. L. (2002). Individual differences in children's understanding of emotion: The roles of attachment and language. *Attachment and Human Development, 4*, 39–54.

Diener, M. L., Mangelsdorf, S. C., McHale, J. L., & Frosch, C. A. (2002). Infants' behavioral strategies for emotion regulation with fathers and mothers: Associations with emotional expressions and attachment quality. *Infancy, 3*(2), 153–174.

Dodd, H. F., Hudson, J. L., Morris, T. M., & Wise, C. K. (2012). Interpretation bias in preschool children at risk for anxiety: A prospective study. *Journal of Abnormal Psychology, 121*, 28–38.

Dubi, K., Rapee, R. M., Emerton, J. L., & Schniering, C. A. (2008). Maternal modeling and the acquisition of fear and avoidance in toddlers: Influence of stimulus preparedness and child temperament. *Journal of Abnormal Child Psychology, 36*, 499–512.

Dyson, M. W., Klein, D. N., Olino, T. M., Dougherty, L. R., & Durbin, C. E. (2011). Social and non-social behavioral inhibition in preschool-age children: Differential associations with parent-reports of temperament and anxiety. *Child Psychiatry and Human Behavior, 42*, 390–405.

Edwards, S. L., Rapee, R. M., & Kennedy, S. (2010). Prediction of anxiety symptoms in preschool-aged children: Examination of maternal and paternal perspectives. *Journal of Child Psychology and Psychiatry, 51*, 313–321.

Ehrenreich-May, J., & Bilek, E. L. (2012). The development of a transdiagnostic, cognitive behavioral group intervention for childhood anxiety disorders and co-occurring depression symptoms. *Cognitive and Behavioral Practice, 19*, 41–55.

Ehrenreich, J. T., Goldstein, C. M., Wright, L. R., & Barlow, D. H. (2009). Development of a unified protocol for the treatment of emotional disorders in youth. *Child & Family Behavior Therapy, 31*, 20–37.

Eisenberg, N., Cumberland, A., & Spinrad, T. L. (1998). Parental socialization of emotion. *Psychological Inquiry, 9*, 241–273.

Eley, T. C., Bolton, D., O'connor, T. G., Perrin, S., Smith, P., & Plomin, R. (2003). A twin study of anxiety-related behaviours in pre-school children. *Journal of Child Psychology and Psychiatry, 44*(7), 945–960.

Else-Quest, N. M., Hyde, J. S., Goldsmith, H. H., & Can Hulle, C. A. (2006). Gender differences in temperament: A meta-analysis. *Psychological Bulletin, 132*(1), 33–72.

Enlow, M. B., Egeland, B., Carlson, E., Blood, E., & Wright, R. J. (2014). Mother-infant attachment and the intergenerational transmission of posttraumatic stress disorder. *Development and Psychopathology, 26*, 41–65.

Essex, M. J., Klein, M. H., Slattery, M. J., Goldsmith, H. H., & Kalin, N. H. (2010). Early risk factors and developmental pathways to chronic high inhibition and social anxiety disorder in adolescence. *American Journal of Psychiatry, 167*, 40–46.

Eysenck, M. W., Mogg, K., May, J., Richards, A., & Mathews, A. (1991). Bias in interpretation of ambiguous sentences related to threat in anxiety. *Journal of Abnormal Psychology, 100*, 144–150.

Field, A. P., & Price-Evans, K. (2009). Temperament moderates the effect of the verbal threat information pathway on children's heart rate responses to novel animals. *Behaviour Research and Therapy, 47*, 431–436.

Fox, N. A., Henderson, H. A., Rubin, K. H., Calkins, S. D., & Schmidt, L. A. (2001). Continuity and discontinuity of behavioral inhibition and exuberance: Psychophysiological and behavioral influences across the first four years of life. *Child Development, 72*, 1–21.

Fu, X., Taber-Thomas, B. C., & Pérez-Edgar, K. (2017). Frontolimbic functioning during threat-related attention: Relations to early behavioral inhibition and anxiety in children. *Biological Psychology, 122*, 98–109.

Fulton, J. J., Kiel, E. J., Tull, M. T., & Gratz, K. L. (2014). Associations between parental overprotection, experiential avoidance, and anxiety. *Journal of Experimental Psychopathology, 5*, 200–211.

Furstenberg, F., Belzer, A., Davis, C., Levine, J. A., Morrow, K., & Washington, M. (1993). How families manage risk and opportunity in dangerous neighborhoods. In W. J. Wilson (Ed.), *Sociology and the public agenda* (pp. 231–258). Newbury Park, CA: Sage.

Gibler, R. C., Kalomiris, A. E., & Kiel, E. J. (2018). Paternal anxiety in relation to toddler anxiety: The mediating role of maternal behavior. *Child Psychiatry & Human Development, 49*(4), 512–522.

Ginsburg, G. S., Siqueland, L., Masia-Warner, C., & Hedtke, K. A. (2004). Anxiety disorders in children: Family matters. *Cognitive and Behavioral Practice, 11*, 28–43.

Goldin, P. R., Ziv, M., Jazaieri, H., Weeks, J., Heimberg, R. G., & Gross, J. J. (2014). Impact of cognitive-behavioral therapy for social anxiety disorder on the neural bases of emotional reactivity to and regulation of social evaluation. *Behaviour Research and Therapy, 62*, 97–106.

Goldner, J. S., Quimby, D., Richards, M. W., Zakaryan, A., Miller, S., Dickson, D., & Chilson, J. (2016). Relations of parenting to adolescent externalizing and internalizing distress moderated by perception of neighborhood danger. *Journal of Clinical Child and Adolescent Psychology, 45*, 141–154.

Goldsmith, H. H., Buss, A. H., Plomin, R., Rothbart, M. K., Thomas, A., Chess, S., … McCall, R. B. (1987). Roundtable: What is temperament? Four approaches. *Child Development, 58*, 505–529.

Goldsmith, H. H., & Campos, J. J. (1982). Toward a theory of infant temperament. In R. N. Emde & R. J. Harmon (Eds.), *The development of attachment and affiliative systems* (pp. 161–193). New York, NY: Erlbaum.

Goodman, G., Stroh, A., & Valdez, A. (2012). Do attachment representations predict depression and anxiety in psychiatrically hospitalized prepubertal children? *Bulletin of the Menninger Clinic, 76*, 260–289.

Groh, A. M., Narayan, A., Bakermans-Kranenburg, M. J., Roisman, G. I., Vaughn, B. E., Fearon, R. P., & van IJzendoorn, M. H. (2012). Attachment and temperament in the early life course: A meta-analytic review. *Child Development, 88*, 770–795.

Groh, A. M., Roisman, G. I., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Fearon, R. P. (2012). The significance of insecure and disorganized attachment for children's internalizing symptoms: A meta-analytic study. *Child Development, 83*, 591–610.

Greenfield, P. M., Keller, H., Fuligni, A., & Maynard, A. (2003). Cultural pathways through universal development. *Annual Review of Psychology, 54*, 461–490.

Gullone, E., & King, N. J. (1993). The fears of youth in the 1990s: Contemporary normative data. *Journal of Genetic Psychology, 154*, 137–153.

Gullone, E., & King, N. J. (1997). Three-year follow-up of normal fear in children and adolescents aged 7 to 18 years. *British Journal of Developmental Psychology, 15*, 97–111.

Gullone, E., King, N. J., & Ollendick, T. H. (2001). Self-reported anxiety in children and adolescents: A three-year follow-up study. *Journal of Genetic Psychology, 162*, 5–19.

Guyer, A. E., Choate, V. R., Detloff, A., Benson, B., Nelson, E. E., Pérez-Edgar, K., … Ernst, M. (2012). Striatal functional alteration during incentive anticipation in pediatric anxiety disorders. *American Journal of Psychiatry, 169*, 205–212.

Guyer, A. E., Lau, J. Y., McClure-Tone, E. B., Parrish, J., Shiffrin, N. D., Reynolds, R. C., … Ernst, M. (2008). Amygdala and ventrolateral prefrontal cortex function during anticipated peer evaluation in pediatric social anxiety. *Archives of General Psychiatry, 65*, 1303–1312.

Hadwin, J. A., Garner, M., & Perez-Olivas, G. (2006). The development of information processing biases in childhood anxiety: A review and exploration of its origins in parenting. *Clinical Psychology Review, 26*, 876–894.

Hane, A. A., & Barrios, E. S. (2011). Mother and child interpretations of threat in ambiguous situations: Relations with child anxiety and autonomic responding. *Journal of Family Psychology, 25*(5), 644–652.

Hane, A. A., Fox, N. A., Henderson, H. A., & Marshall, P. J. (2008). Behavioral reactivity and approach-withdrawal bias in infancy. *Developmental Psychology, 44*(5), 1491–1496.

Hankin, B. L., Davis, E. P., Snyder, H., Young, J. F., Glynn, L. M., & Sandman, C. A. (2017). Temperament factors and dimensional, latent bifactor models of child psychopathology: Transdiagnostic and specific associations in two youth samples. *Psychiatry Research, 252*, 139–146.

Hannesdottir, D. H., & Ollendick, T. H. (2007). The role of emotion regulation in the treatment of childhood anxiety disorders. *Clinical Child and Family Psychology Review, 10*, 275–293.

Hastings, P. D., Helm, J., Mills, R. S. L., Serbin, L. A., Stack, D. M., & Schwartzman, A. E. (2015). Dispositional and environmental predictors of the development of internalizing problems in childhood: Testing a multilevel model. *Journal of Abnormal Child Psychology, 43*, 831–845.

Hatzenbuehler, M. L., McLaughlin, K. A., & Nolen-Hoeksema, S. (2008). Emotion regulation and internalizing symptoms in a longitudinal study of sexual minority and heterosexual adolescents. *Journal of Child Psychology and Psychiatry, 49*, 1270–1278.

Hirshfeld-Becker, D. R., Biederman, J., Henin, A., Faraone, S. V., Davis, S., Harrington, K., & Rosenbaum, J. F. (2007). Behavioral inhibition is preschool children at risk is a specific predictor of middle childhood social anxiety: A five-year follow-up study. *Journal of Developmental and Behavioral Pediatrics, 28*, 225–233.

Hudson, J. L., Kendall, P. C., Coles, M. E., Robin, J. A., & Webb, A. (2002). The other side of the coin: Using intervention research in child anxiety disorders to inform developmental psychopathology. *Development and Psychopathology, 14*, 819–841.

Hughes, A. A., & Kendall, P. C. (2009). Psychometric properties of the Positive and Negative Affect Scale for Children (PANAS-C) in children with anxiety disorders. *Child Psychiatry & Human Development, 40*, 343–352.

Hurrell, K. E., Houwing, F. L., & Hudson, J. L. (2017). Parental meta-emotion philosophy and emotion coaching in families of children and adolescents with an anxiety disorder. *Journal of Abnormal Child Psychology, 45*, 569–582.

Infants' Behavioral Strategies for Emotion Regulation With Fathers and Mothers: Associations With Emotional Expressions and Attachment Quality

Ingram, R. E., Bailey, K., & Siegle, G. (2004). Emotional information processing and disrupted parental bonding: Cognitive specificity and avoidance. *Journal of Cognitive Psychotherapy: An International Quarterly, 18*, 53–65.

Izard, C. E., Fine, S., Mostow, A., Trentacosta, C., & Campbell, J. (2002). Emotion processes in normal and abnormal development and preventive intervention. *Development and Psychopathology, 14*, 761–787.

Jacob, M. L., Thomassin, K., Morelen, D., & Suveg, C. (2011). Emotion regulation in childhood anxiety. In D. McKay & E. A. Storch (Eds.), *Handbook of child and adolescent anxiety disorders* (pp. 171–185). New York: Springer.

Jacques, H. A., & Mash, E. J. (2004). A test of the tripartite model of anxiety and depression in elementary and high school boys and girls. *Journal of Abnormal Child Psychology, 32*, 13–25.

Joiner, T. E., Catanzaro, S. J., & Laurent, J. (1996). Tripartite structure of positive and negative affect, depression, and anxiety in child and adolescent psychiatric inpatients. *Journal of Abnormal Psychology, 105*, 401–409.

Julia M. Braungart, Cynthia A. Stifter, (1991) Regulation of negative reactivity during the strange situation: Temperament and attachment in 12-month-old infants. Infant Behavior and Development 14 (3):349–364

Kagan, J. (1998). Biology and the child. In W. Damon & N. Eisenberg (Eds.), *Handbook of child psychology: Social, emotional, and personality development* (pp. 177–235). Hoboken, NJ: John Wiley.

Kagan, J., Reznick, J. S., Clarke, C., Snidman, N., & Garcia-Coll, C. (1984). Behavioral inhibition to the unfamiliar. *Child Development, 55*, 2212–2225.

Kagan, J., Reznick, J. S., & Gibbons, J. (1989). Inhibited and uninhibited types of children. *Child Development, 60*, 838–845.

Kagan, J., Reznick, J. S., & Snidman, N. (1988). Biological bases of childhood shyness. *Science, 240*, 167–171.

Kagan, J., & Snidman, N. (1991). Infant predictors of inhibited and uninhibited profiles. *Psychological Science, 2*, 40–44.

Kagan, J., & Snidman, N. (1999). Early childhood predictors of adult anxiety disorders. *Biological Psychiatry, 46*, 1536–1541.

Kagan, J., Snidman, N., Arcus, D., & Reznick, R. J. (1994). *Galen's prophecy: Temperament in human nature*. New York, NY: Basic Books.

Kagam, J., Snidman, N., Zentner, M., & Peterson, E. (1999). Infant temperament and anxious symptoms in school age children. *Development and Psychopathology, 11*, 209–224.

Keenan, K., & Shaw, D. (1997). Developmental and social influences on young girls' early problem behavior. *Psychological Bulletin, 121*, 95–113.

Kendall, P. C., Hudson, J. L., Choudhury, M., Webb, A., & Pimentel, S. (2005). Cognitive-behavioral treatment for childhood anxiety disorders. In E. D. Hibbs & P. S. Jensen (Eds.), *Psychosocial treatments for child and adolescent disorders: Empirically based strategies for clinical practice* (2nd ed., pp. 47–73). Washington, D.C.: APA.

Kendall, P., & Suveg, C. (2005). *Emotion-focused cognitive-behavioral therapy for anxious children: Therapist manual.* Unpublished manual.

Kertes, D. A., Donzella, B., Talge, N. M., Garvin, M. C., Van Ryzin, M. J., & Gunnar, M. R. (2009). Inhibited temperament and parent emotional availability differentially predict young children's cortisol responses to novel social and nonsocial events. *Developmental Psychobiology, 51*, 521–532.

Kiel, E. J., & Buss, K. A. (2011). Prospective relations among fearful temperament, protective parenting, and social withdrawal: The role of maternal accuracy in a moderated mediation framework. *Journal of Abnormal Child Psychology, 39*, 953–966.

Kiel, E. J., & Buss, K. A. (2012). Associations among toddler fearful temperament, context-specific maternal protective behavior, and maternal accuracy. *Social Development, 21*, 742–760.

Kiel, E. J., & Buss, K. A. (2014). Dysregulated fear in toddlerhood predicts kindergarten social withdrawal through protective parenting. *Infant and Child Development, 23*, 304–313.

Klumpp, H., Roberts, J., Kennedy, A. E., Shankman, S. A., Langenecker, S. A., Gross, J. J., & Phan, K. L. (2017). Emotion regulation related neural predictors of cognitive behavioral therapy response in social anxiety disorder. *Progress in Neuro-Psychopharmacology & Biological Psychiatry, 75*, 106–112.

Kring, A. M., & Sloan, D. M. (2009). *Emotion regulation and psychopathology: A transdiagnostic approach to etiology and treatment*. New York: Guilford Press.

Lau, J. Y., Guyer, A. E., Tone, E. B., Jenness, J., Parrish, J. M., Pine, D. S., & Nelson, E. E. (2012). Neural responses to peer rejection in anxious adolescents: Contributions from the amygdala-hippocampal complex. *International Journal of Behavioral Development, 36*, 36–44.

Laurin, J. C., Joussemet, M., Tremblay, R. E., & Boivin, M. (2015). Early forms of controlling parenting and the development of childhood anxiety. *Journal of Child and Family Studies, 24*, 3279–3292.

Lewinsohn, P. M., Gotlib, I. H., Lewinsohn, M., Seeley, J. R., & Allen, N. B. (1998). Gender differences in anxiety disorders and anxiety symptoms in adolescents. *Journal of Abnormal Psychology, 107*, 109–117.

Lewis-Morrarty, E., Degnan, K. A., Chronis-Tuscano, A., Pine, D. S., Henderson, H. A., & Fox, N. A. (2015). Infant attachment security and early childhood behavioral inhibition interact to predict adolescent social anxiety symptoms. *Child Development, 86*, 598–613.

Lewis-Morrarty, E., Degnan, K. A., Chronis-Tuscano, A., Rubin, K. H., Cheah, C. S. L., Pine, D. S., … Fox, N. A. (2012). Maternal over-control moderates the association between early childhood behavioral inhibition and adolescent social anxiety symptoms. *Journal of Abnormal Child Psychology, 40*, 1363–1373.

LoBue, V., & DeLoache, J. S. (2008). Detecting the snake in the grass: Attention to fear-relevant stimuli by adults and young children. *Psychological Science, 19*(3), 284–289.

LoBue, V., & Pérez-Edgar, K. (2014). Sensitivity to social and non-social threats in temperamentally shy children at risk for anxiety. *Developmental Science, 17*, 239–247.

Lonigan, C. J., & Phillips, B. M. (2001). Temperamental influences on the development of anxiety disorders. In M. W. Vasey & M. R. Dadds (Eds.), *The developmental psychopathology of anxiety* (pp. 60–91). New York, NY: Oxford University Press.

MacDonald, H. Z., Beeghly, M., Grant-Knight, W., Augustyn, M., Woods, R., Cabral, H., … Frank, D. A. (2008). Longitudinal association between infant disorganized attachment and childhood posttraumatic

stress symptoms. *Development and Psychopathology, 20*, 493–508.

MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional bias in emotional disorders. *Journal of Abnormal Psychology, 95*(1), 15–20.

Madigan, S., Atkinson, L., Laurin, K., & Benoit, D. (2013). Attachment and internalizing behavior in early childhood: A meta-analysis. *Developmental Psychology, 49*, 672–689.

Main, M., & Hesse, E. (1990). Parents' unresolved traumatic experiences are related to infant disorganized attachment status. Is frightened and/or frightening parental behavior the linking mechanism? In M. T. Greenberg, D. Cicchetti, & E. M. Cummings (Eds.), *The John D. and Catherine T. MacArthur Foundation series on mental health and development. Attachment in the preschool years: Theory, research, and intervention* (pp. 161–182). Chicago: University of Chicago Press.

Manfredi, C., Caselli, G., Rovetto, F., Rebecchi, D., Ruggiero, G. M., Sassaroli, S., & Spada, M. M. (2011). Temperament and parental styles as predictors of ruminative brooding and worry. *Personality and Individual Differences, 50*, 186–191.

Mathews, B. L., Kerns, K. A., & Ciesla, J. A. (2014). Specificity of emotion regulation difficulties related to anxiety in early adolescence. *Journal of Adolescence, 37*, 1089–1097.

Mathews, B. L., Koehn, A. J., Abtahi, M. M., & Kerns, K. A. (2016). Emotional competence and anxiety in childhood and adolescence: A meta-analytic review. *Clinical Child and Family Psychology Review, 19*, 162–184.

McClure, E. B., & Pine, D. S. (2006). Social anxiety and emotion regulation: A model for developmental psychopathology perspectives on anxiety disorders. In (D. Cicchetti & D. J. Cohen (Eds.), Developmental psychopathology: Risk, disorder, and adaptation., Vol. 3 (2nd ed), pp 470-503. Hoboken, NJ: John Wiley & Sons Inc.

McClure, E. B., Monk, C. S., Nelson, E. E., Parrish, J. M., Adler, A., Blair, R. J. R., … Pine, D. S. (2007). Abnormal attention modulation of fear circuit function in pediatric generalized anxiety disorder. *Archives of General Psychiatry, 64*, 97–106.

McCord, B. L., & Raval, V. V. (2016). Asian Indian immigrant and White American maternal emotion socialization and child socio-emotional functioning. *Journal of Child and Family Studies, 25*, 464–474.

Mennin, D. S. (2004). Emotion regulation therapy for generalized anxiety disorder. *Clinical Psychology and Psychotherapy, 11*, 17–29.

Mennin, D. S., Heimberg, R. G., Turk, C. L., & Fresco, D. M. (2002). Applying an emotion regulation framework to integrative approaches to generalized anxiety disorder. *Clinical Psychology: Science and Practice, 9*, 85–90.

Mennin, D. S., Heimberg, R. G., Turk, C. L., & Fresco, D. M. (2005). Preliminary evidence for an emotion dysregulation model of generalized anxiety disorder. *Behaviour Research and Therapy, 43*, 1281–1310.

Merikangas, K. R., Lieb, R., Wittchen, H. U., & Avenevoli, S. (2003). Family and high-risk studies of social anxiety disorder. *Acta Psychiatrica Scandinavica, 108*(s417), 28–37.

Meyer, A., Hajcak, G., Torpey, D. C., Kujawa, A., Kim, J., Bufferd, S., … Klein, D. N. (2013). Increased error-related brain activity in six-year-old children with clinical anxiety. *Journal of Abnormal Child Psychology, 41*, 1257–1266.

Mian, N. D., Wainwright, L., Briggs-Gowan, M. J., & Carter, A. S. (2011). An ecological risk model for early childhood anxiety: The importance of early child symptoms and temperament. *Journal of Abnormal Child Psychology, 39*, 501–512.

Micco, J. A., Henin, A., Mick, E., Kim, S., Hopkins, C. A., Biederman, J., & Hirshfeld-Becker, D. R. (2009). Anxiety and depressive disorders in offspring at high risk for anxiety: A meta-analysis. *Journal of Anxiety Disorders, 23*(8), 1158–1164.

Mirabile, S. P., Oertwig, D., & Halberstadt, A. G. (2018). Parent emotion socialization and children's socioemotional adjustment: When is supportiveness no longer supportive? *Social Development, 27*(3), 466–481. https://doi.org/10.1111/sode.12226

Miskovic, V., Campbell, M. J., Santesso, D. L., Ameringen, M. V., Mancini, C. L., & Schmidt, L. A. (2011). Frontal brain oscillatory coupling in children of parents with social phobia: A pilot study. *Journal of Neuropsychiatry and Clinical Neurosciences, 23*, 111–114.

Mount, K. S., Crockenberg, S. C., Bárrig Jó, P. S., & Wagar, J. (2010). Maternal and child correlates of anxiety in 2 1/2–year-old children. *Infant Behavior and Development, 33*, 567–578.

Morales, S., Pérez-Edgar, K., & Buss, K. A. (2015). Attention bias towards and away from threat mark the relation between early dysregulated fear and the later emergence of social withdrawal. *Journal of Abnormal Child Psychology, 43*, 1067–1078.

Morales, S., Taber-Thomas, B. C., & Pérez-Edgar, K. E. (2017). Patterns of attention to threat across tasks in behaviorally inhibited children at risk for anxiety. *Developmental Science, 20*, 1–9.

Morris, A. S., Silk, J. S., Steinberg, L., Myers, S. S., & Robinson, L. R. (2007). The role of the family context in the development of emotion regulation. *Social Development, 16*, 361–388.

Müller, M., Tronick, E., Zietlow, A., Nonnenmacher, N., Vershoor, S., & Träuble, B. (2016). Effects of maternal anxiety disorders on infant self-comforting behaviors: The role of maternal bonding, infant gender, and age. *Psychopathology, 49*, 295–304.

Muris, P., Mayer, B., den Adel, M., Roos, T., & van Wamelen, J. (2009). Predictors of change following cognitive-behavioral treatment of children with anxiety problems: A preliminary investigation on negative automatic thoughts and anxiety control. *Child Psychiatry and Human Development, 40*, 139–151.

Muris, P., & Meesters, C. (2002). Attachment, behavioral inhibition, and anxiety disorders symptoms in

normal adolescents. *Journal of Psychopathology and Behavioral Assessment, 24*, 97–106.

Muris, P., Merckelbach, H., Gadet, B., & Moulaert, V. (2000). Fears, worries, and scary dreams in 4- to 12-year-old children: Their content, developmental pattern, and origins. *Journal of Clinical Child Psychology, 29*, 43–52.

Muris, P., & van Doorn, M. (2003). "Danger is lurking everywhere, even in parts of a Jigsaw puzzle": Anxiety-related threat perception abnormalities in children: Their assessment with projective material. *Behaviour Change, 20*, 151–159.

Murray, L., Creswell, C., & Cooper, P. J. (2009). The development of anxiety disorders in childhood: An integrative review. *Psychological Medicine, 39*, 1413–1423.

Neumann, A., van Lier, P. A., Gratz, K. L., & Koot, H. M. (2010). Multidimensional assessment of emotion regulation difficulties in adolescents using the difficulties in emotion regulation scale. *Assessment, 17*, 138–149.

Nicol-Harper, R., Harvey, A. G., & Stein, A. (2007). Interactions between mothers and infants: Impact of maternal anxiety. *Infant Behavior and Development, 30*(1), 161–167.

Öhman, A. (2008). Fear and anxiety: Overlaps and dissociations. In M. Lewis, J. M. Haviland-Jones, & L. Feldman Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 709–729). New York, NY: Guilford Press.

Ollendick, T. H., King, N. J., & Chorpita, B. F. (2006). Empirically supported treatments for children and adolescents. In P. C. Kendall (Ed.), *Child and adolescent therapy: Cognitive-behavioral procedures* (pp. 492–520). New York: Guilford Press.

Ooi, J., Dodd, H. F., & Walsh, J. (2015). Shared cognition in childhood anxiety: Interpretation bias in preschool children and their parents. *Journal of Child and Family Studies, 24*, 3413–3422.

Padrón, E., Carlson, E. A., & Sroufe, L. A. (2014). Frightened versus not frightened disorganized infant attachment: Newborn characteristics and maternal caregiving. *American Journal of Orthopsychiatry, 84*, 201–208.

Pass, L., Arteche, A., Cooper, P., Creswell, C., & Murray, L. (2012). Doll play narratives about starting school in children of socially anxious mothers, and their relation to subsequent child school-based anxiety. *Journal of Abnormal Child Psychology, 40*, 1375–1384.

Perez, S. M., & Gauvain, M. (2007). The sociocultural context of transitions in early socioemotional development. In C. A. Brownell & C. B. Kopp (Eds.), *Socioemotional development in the toddler years* (pp. 396–419). New York, NY: Guilford Press.

Pérez-Edgar, K. E., & Guyer, A. E. (2014). Behavioral inhibition: Temperament or prodrome? *Current Behavioral Neuroscience Reports, 1*, 182–190.

Pérez-Edgar, K., Kujawa, A., Nelson, K., Cole, C., & Zapp, D. J. (2013). The relation between electroencephalogram asymmetry and attention biases to threat at baseline and under stress. *Brain and Cognition, 82*, 337–343.

Pérez-Edgar, K., Reeb-Sutherland, B. C., McDermott, J. M., White, L. A., Henderson, H. A., Degnan, K. A., … Fox, N. A. (2011). Attention biases to threat link behavioral inhibition and social withdrawal over time in very young children. *Journal of Abnormal Child Psychology, 39*, 885–895.

Phelps, R. A., Brooker, R. J., & Buss, K. A. (2016). Toddlers' dysregulated fear predicts delta-beta coupling during preschool. *Developmental Cognitive Neuroscience, 17*, 28–34.

Pincus, D. B., Ehrenreich-May, J., Whitton, S. W., Mattis, S. G., & Barlow, D. H. (2010). Cognitive-behavioral treatment of panic disorder in adolescence. *Journal of Clinical Child and Adolescent Psychology, 39*, 638–649.

Pine, D. S. (2007). Research review: A neuroscience framework for pediatric anxiety disorders. *Journal of Child Psychology and Psychiatry, 48*, 631–648.

Prior, M., Smart, D., Sanson, A., & Oberklaid, F. (2000). Does shy-inhibited temperament in childhood lead to anxiety problems in adolescence? *Journal of the American Academy of Child and Adolescent Psychiatry, 39*, 461–468.

Rapee, R. M., Craske, M. G., Brown, T. A., & Barlow, D. H. (1996). Measurement of perceived control over anxiety-related events. *Behavior Therapy, 27*, 279–293.

Rapee, R. M., Kennedy, S., Ingram, M., Edwards, S., & Sweeney, L. (2005). Prevention and early intervention of anxiety disorders in inhibited preschool children. *Journal of Consulting and Clinical Psychology, 73*, 488–497.

Rapee, R. M., Kennedy, S., Ingram, M., Edwards, S., & Sweeney, L. (2010). Altering the trajectory of anxiety in at-risk young children. *American Journal of Psychiatry, 167*, 1518–1525.

Raval, V. V., Raval, P. H., Salvina, J. M., Wilson, S. L., & Writer, S. (2013). Mothers' socialization of children's emotion in India and the USA: A cross- and within-culture comparison. *Social Development, 22*, 467–484.

Reeb-Sutherland, B. C., Vanderwert, R. E., Degnan, K. A., Marshall, P. J., Pérez-Edgar, K., Chronis-Tuscano, A., … Fox, N. A. (2009). Attention to novelty in behaviorally inhibited adolescents moderates risk for anxiety. *Child Psychology and Psychiatry, 50*, 1365–1372.

Reeb-Sutherland, B. C., Williams, L. R., Degnan, K. A., Pérez-Edgar, K., Chronis-Tuscano, A., Leibenluft, E., … Fox, N. A. (2015). Identification of emotional facial expressions among behaviorally inhibited adolescents with lifetime anxiety disorders. *Cognition and Emotion, 29*, 372–382.

Reznick, J. S., Kagan, J., Snidman, N., Gersten, M., Baak, K., & Rosenberg, A. (1986). Inhibited and uninhibited children: A follow-up study. *Child Development, 57*, 660–680.

Rieffe, C., Oosterveld, P., Miers, A. C., Terwogt, M. M., & Ly, V. (2008). Emotion awareness and internalising symptoms in children and adolescents: The Emotion Awareness Questionnaire revised. *Personality and Individual Differences, 45*, 756–761.

Rothbart, M. K., & Derryberry, D. (1981). Development of individual differences in temperament. In M. E. lamb & A. L. Brown (Eds.), *Advances in developmental psychology* (Vol. 1, pp. 37–86). Hillsdale, NJ: Erlbaum.

Roy, A. K., Benson, B. E., Degnan, K. A., Pérez-Edgar, K., Pine, D. S., Fox, N. A., & Ernst, M. (2014). Alterations in amygdala functional connectivity reflect early temperament. *Biological Psychology, 103*, 248–254.

Roza, S. J., Hofstra, M. B., van der Ende, J., & Verhulst, F. C. (2003). Stable prediction of mood and anxiety disorders based on behavioral and emotional problems in childhood: A 14-year follow-up during childhood, adolescence, and young adulthood. *American Journal of Psychiatry, 160*, 2116–2121.

Rubin, K. H., Coplan, R. J., & Bowker, J. (2009). Social withdrawal in childhood. *Annual Review of Psychology, 60*, 141–171.

Rubin, K. H., Hastings, P. D., Stewart, S. L., Henderson, H. A., & Chen, X. (1997). The consistency and concomitants of inhibition: Some of the children, all of the time. *Child Development, 68*, 467–483.

Rubin, K. H., Hemphill, S. A., Chen, X., Hastings, P., Sanson, A., Lococo, A., … Doh, H. S. (2006). Parenting beliefs and behaviors: Initial findings from the International Consortium for the Study of Social and Emotional Development (ICSSED). In K. H. Rubin & O. B. Chung (Eds.), *Parenting beliefs, behaviors, and parent-child relations: A cross-cultural perspective* (pp. 81–103). New York, NY: Psychology Press.

Rutter, M., & Sroufe, L. A. (2000). Developmental psychopathology: Concepts and challenges. *Development and Psychopathology, 12*, 265–296.

Salters-Pedneault, K., Roemer, L., Tull, M. T., Rucker, L., & Mennin, D. S. (2006). Evidence of broad deficits in emotion regulation associated with chronic worry and generalized anxiety disorder. *Cognitive Therapy and Research, 30*, 469–480.

Schwartz, C. E., Wright, C. I., Shin, L. M., Kagan, J., & Rauch, S. L. (2003). Inhibited and uninhibited infants "grown up": Adult amygdalar response to novelty. *Science, 300*, 1952–1953.

Sendzik, L., Schäfer, J. Ö., Samson, A. C., Naumann, E., & Tuschen-Caffier, B. (2017). Emotional awareness in depressive and anxiety symptoms in youth: A meta-analytic review. *Journal of Youth and Adolescence, 46*, 687–700.

Shamir-Essakow, G., Ungerer, J. A., & Rapee, R. M. (2005). Attachment, behavioral inhibition, and anxiety in preschool children. *Journal of Abnormal Child Psychology, 33*, 131–143.

Shechner, T., Jarcho, J. M., Britton, J. C., Leibenluft, E., Pine, D. S., & Nelson, E. E. (2013). Attention bias of anxious youth during extended exposure of emotional face pairs: An eye-tracking study. *Depression and Anxiety, 30*, 14–21.

Shirtcliff, E. A., Peres, J. C., Dismukes, A. R., Lee, Y., & Phan, J. M. (2014). Hormones: Commentary: Riding the physiological roller coaster: Adaptive significance of cortisol stress reactivity to social contexts. *Journal of Personality Disorders, 28*, 40–51.

Silverman, W. K., La Greca, A. M., & Wasserstein, S. (1995). What do children worry about? Worries and their relation to anxiety. *Child Development, 66*, 671–686.

Smith, C. L., Calkins, S. D., & Keane, S. P. (2006). The relation of maternal behavior and attachment security to toddlers' emotions and emotion regulation. *Research in Human Development, 3*, 21–31.

Southam-Gerow, M. A., & Kendall, P. C. (2000). A preliminary study of the emotion understanding of youths referred for treatment of anxiety disorders. *Journal of Clinical Child Psychology, 29*, 319–327.

Spangler, G., & Schieche, M. (1998). Emotional and adrenocortical responses of infants to the strange situation: The differential function of emotion expression. *International Journal of Behavioral Development, 22*, 681–706.

Spinrad, T. L., Eisenberg, N., Gaertner, B., Popp, T., Smith, C. L., Kupfer, A., … Hofer, C. (2007). Relations of maternal socialization and toddlers' effortful control to children's adjustment and social competence. *Developmental Psychology, 43*(5), 1170–1186.

Sroufe, L. A., & Rutter, M. (1984). The domain of developmental psychopathology. *Child Development, 55*, 17–29.

Sroufe, L. A., & Waters, E. (1977). Attachment as an organizational construct. *Child Development, 48*, 1184–1199.

Suveg, C., Kendall, P. C., Comer, J. S., & Robin, J. (2006). Emotion-focused cognitive behavioral therapy for anxious youth: A multiple-baseline evaluation. *Journal of Contemporary Psychotherapy, 36*, 77–85.

Suveg, C., Morelen, D., Brewer, G. A., & Thomassin, K. (2010). The emotion dysregulation model of anxiety: A preliminary path analytic examination. *Journal of Anxiety Disorders, 24*, 924–930.

Suveg, C., Shaffer, A., Morelen, D., & Thomassin, K. (2011). Links between maternal and child psychopathology symptoms: Medication through child emotion regulation and moderation through maternal behavior. *Child Psychiatry and Human Development, 42*, 507.

Suveg, C., Sood, E., Barmish, A., Tiwari, S., Hudson, J. L., & Kendall, P. C. (2008). "I'd rather not talk about it": Emotion parenting in families of children with an anxiety disorder. *Journal of Family Psychology, 22*(6), 875–884.

Suveg, C., Sood, E., Comer, J. S., & Kendall, P. C. (2009). Changes in emotion regulation following cognitive-behavioral therapy for anxious youth. *Journal of Clinical Child and Adolescent Psychology, 38*, 390–401.

Suveg, C., & Zeman, J. (2004). Emotion regulation in children with anxiety disorders. *Journal of Clinical Child and Adolescent Psychology, 33*, 750–759.

Suveg, C., Zeman, J., Flannery-Schroeder, E., & Cassano, M. (2005). Emotion socialization in families of children with an anxiety disorder. *Journal of Abnormal Child Psychology, 33*, 145–155.

Taghavi, M. R., Moradi, A. R., Neshat-Doost, H. T., Yule, W., & Dalgleish, T. (2000). Interpretation of ambiguous emotional information in clinically anxious children and adolescents. *Cognition & Emotion, 14*, 809–822.

Talge, N. M., Donzella, B., & Gunnar, M. R. (2008). Fearful temperament and stress reactivity among preschool age children. *Infant and Child Development, 17*, 427–445.

Teetsel, R. N., Ginsburg, G. S., & Drake, K. L. (2014). Anxiety-promoting parenting behaviors: A comparison of anxious mothers and fathers. *Child Psychiatry & Human Development, 45*(2), 133–142.

Thai, N., Taber-Thomas, B. C., & Pérez-Edgar, K. E. (2016). Neural correlates of attention biases, behavioral inhibition, and social anxiety in children: An ERP study. *Developmental Cognitive Neuroscience, 19*, 200–210.

Thompson, R. A. (1994). Emotion regulation: A theme in search of definition. *Monographs of the Society for Research in Child Development, 59*(2–3), 25–52.

Thompson, R. A., & Calkins, S. D. (1996). The double-edged sword: Emotion regulation for children at risk. *Development and Psychopathology, 8*, 163–182.

Turner, S. M., Beidel, D. C., Roberson-Nay, R., & Tervo, K. (2003). Parenting behaviors in parents with anxiety disorders. *Behaviour Research and Therapy, 41*(5), 541–554.

Ursache, A., Blair, C., Stifter, C., & Voegtline, K. (2013). Emotional reactivity and regulation in infancy interact to predict executive functioning in early childhood. *Developmental Psychology, 49*, 127–137.

van der Bruggen, C. O., Bögels, S. M., & van Zeilst, N. (2010). What influences parental controlling behaviour? The role of parent and child trait anxiety. *Cognition and Emotion, 24*(1), 141–149.

van der Bruggen, C. O., Stams, G. J. J., & Bögels, S. M. (2008). Research review: The relation between child and parent anxiety and parental control: A meta-analytic review. *Journal of Child Psychology and Psychiatry, 49*(12), 1257–1269.

van der Bruggen, C. O., Stams, G. J. J., Bögels, S. M., & Paulussen-Hoogeboom, M. C. (2010). Parenting behaviour as a mediator between young children's negative emotionality and their anxiety/depression. *Infant and Child Development, 19*, 354–365.

van Hulle, C. A., Moore, M. N., Lemery-Chalfant, K., Goldsmith, H. H., & Brooker, R. J. (2017). Infant stranger fear trajectories predict anxious behaviors and diurnal cortisol rhythm during childhood. *Development and Psychopathology, 29*(3), 1119–1130.

van Ijzendoorn, M. H., & Sagi-Schwartz, A. (2008). Cross-cultural patterns of attachment: Universal and contextual dimensions. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (2nd ed., pp. 880–905). New York, NY: Guilford Press.

Viana, A. G., Dixon, L. J., Stevens, E. N., & Ebesutani, C. (2016). Parental emotion socialization strategies and their interaction with child interpretation biases among children with anxiety disorders. *Cognitive Therapy and Research, 40*, 717–731.

Warren, S. L., Huston, L., Egeland, B., & Sroufe, L. A. (1997). Child and adolescent anxiety disorders and early attachment. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*, 637–644.

Weems, C. F., & Silverman, W. K. (2006). An integrative model of control: Implications for understanding emotion regulation and dysregulation in childhood anxiety. *Journal of Affective Disorders, 91*, 113–124.

Weems, C. F., Silverman, W. K., Rapee, R. M., & Pina, A. A. (2003). The role of control in childhood anxiety disorders. *Cognitive Therapy and Research, 27*, 557–568.

Weems, C. F., Zakem, A. H., Costa, N. M., Cannon, M. F., & Watts, S. E. (2005). Physiological response and childhood anxiety: Association with symptoms of anxiety disorders and cognitive bias. *Journal of Clinical Child and Adolescent Psychology, 34*, 712–723.

White, L. K., Degnan, K. A., Henderson, H. A., Pérez-Edgar, K., Walker, O. L., Shechner, T., … Fox, N. A. (2017). Developmental relations among behavioral inhibition, anxiety, and attention biases to threat and positive information. *Child Development, 88*, 141–155.

Wilson, E. J., MacLeod, C., Mathews, A., & Rutherford, E. M. (2006). The causal role of interpretive bias in anxiety reactivity. *Journal of Abnormal Psychology, 115*, 103–111.

Wirtz, C. M., Hofmann, S. G., Riper, H., & Berking, M. (2014). Emotion regulation predicts anxiety over a five-year interval: A cross-lagged panel analysis. *Depression and Anxiety, 31*, 87–95.

Woodruff-Borden, J., Morrow, C., Bourland, S., & Cambron, S. (2002). The behavior of anxious parents: Examining mechanisms of transmission of anxiety from parent to child. *Journal of Clinical Child and Adolescent Psychology, 31*(3), 364–374.

Zahn-Waxler, C., Klimes-Dougan, B., & Slattery, M. J. (2000). Internalizing problems of childhood and adolescence: Prospects, pitfalls, and progress in understanding the development of anxiety and depression. *Development and Psychopathology, 12*, 443–466.

Zeman, J., Shipman, K., & Penza-Clyve, S. (2001). Development and initial validation of the Children's Sadness Management Scale. *Journal of Nonverbal Behavior, 25*, 187–205.

Emotional Development and Depression

Alyssa R. Palmer, Shreya Lakhan-Pal, and Dante Cicchetti

Abstract

Depression is one of the most common, debilitating, and costly illnesses worldwide. The disorder affects multiple domains of adaptive functioning, including emotional and cognitive self-regulation, physical health, interpersonal relationships, productivity, and life satisfaction. Investigating the development of depressive symptoms across childhood and adolescence is critical in preventing and understanding its prevalence. In the current chapter, we provide an overview of current and foundational research of depression and internalizing disorders through an affective lens, highlighting roots and consequences in emotion and emotion regulation. We conceptualize depression primarily under a developmental psychopathology perspective. This entails emphasizing normative and pathological processes concurrently, extending across the life course and unfolding dynamically in the developing individual. We provide a comprehensive overview of the developmental timing of symptom onset and course and methodological approaches to the developmental study of depression, including the behavioral, genetic, and biological processes implicated in depressive trajectories. Additionally, we center the individual within the context of parenting, emotion socialization, peer relationships, early adversity, and cultural values. Finally, we provide a commentary on the importance of preventive and intervention efforts, as well as the current state of behavioral and psychological treatment.

Introduction

Depression is one of the most prevalent, recurrent, costly, and debilitating psychiatric illnesses worldwide. Almost 20% of the US population will experience a clinically significant episode of depression during their life, and approximately 80% of depressed individuals will experience recurrent episodes (Boland & Keller, 2009; Kessler & Wang, 2009). The disorder is multifaceted and affects afflicted individuals' emotions, thoughts, sense of self, behaviors, interpersonal relationships, productivity, and life satisfaction. In addition to individual burden, depression carries an enormous societal and economic cost; treatment-resistant depression results in a cost on

**Both authors contributed equally to this work. Author contributed equally with all other contributors. Alyssa R. Palmer and Shreya Lakhan-Pal*

We are grateful to the Jacobs Foundation and the National Institute of Mental Health for their support of this work.

A. R. Palmer (✉) · S. Lakhan-Pal · D. Cicchetti
Institute of Child Development, University of Minnesota, Minneapolis, MN, USA
e-mail: palme719@umn.edu

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_26

the order of billions of dollars for repeated and continuing treatment (Mrazek, Hornberger, Altar, & Degtiar, 2014). In this chapter, we review depression as it develops through childhood and into adulthood. Over half of all individuals suffering from depression experience their first episode during this time period. However, adult depression, too, has a number of environmental, biological, and genetic antecedents. Before we delve into each of these, we define our use of the term depression, conceptualize depression as primarily an affective disorder, and explain our use of a developmental psychopathology perspective.

What Is Depression?

Depression is typically operationalized in three hierarchically structured ways: depressed mood, depressive syndromes, and clinical diagnoses (Hankin, 2017). Depressed mood denotes feelings of sadness, unhappiness, and irritability. The syndromal level signifies the mood component in addition to typically occurring symptoms such as psychomotor agitation or vegetation, sleep disturbances, cognitive symptoms, or additional affective perturbations. Finally, depressive disorders utilize common psychiatric classifications systems such as *Diagnostic and Statistical Manual for Mental Health Disorders*, 5th edition (DSM-5; American Psychiatric Association, 2013), or *International Classification of Disease Ten* (ICD-10; World Health Organization, 1992). Psychiatric classification systems provide the most standardized definitions of depression and typically include requirements for the length of time symptoms have persisted. In order to be diagnosed with major depressive disorder (MDD), the DSM-5 requires that five or more listed symptoms be present during the same 2-week period. One of the five symptoms must be depressed mood or loss of interest/pleasure. Other listed symptoms include changes in body weight, changes in sleep patterns, increased fatigue, excessive feelings of guilt, decreased ability to focus, and suicidal ideations (American Psychiatric Association, 2013). The only change made for childhood and adolescence is the addition of irritability as a primary mood symptom. However, depression often presents significantly differently across youth. Appropriate functioning given age and developmental tasks must be taken into account. It is essential to understand continuation and etiology of adaptive functioning, given that depressed mood at younger ages carries increased risk for negatively cascading effects, whereby dysfunction at one level of development precedes future difficulties across realms of functioning (cognitive, neural, biological, emotional, social, stress, etc.; Hankin, 2017). As emphasized by an organizational approach to development, multiple interacting systems across development have transitive effects on future functioning and have an interdependent relationship with other systems of functioning (Cicchetti & Schneider-Rosen, 1986).

Although the DSM-5 serves immense clinical utility, relatively more research is conducted by conceptualizing depression on the level of mood or syndrome. This implies a dimensional conceptualization among researchers, in which the experience of depression is a latent-level construct (e.g., Hankin, 2017). This view is gaining momentum with the incorporation of the Research Domain Criteria (RDoC) framework in the investigation of mental disorders. The goal of RDoC is to understand mental health by examining varying degrees of dysfunction across systems. Considering the sizeable heterogeneity within diagnostic categories, supporters of RDoC assert that the DSM classification system has resulted in suboptimal treatment response and an incomplete understanding of underlying mechanisms of mental illness (Insel et al., 2010).

In this chapter, we differentiate between a diagnosis of "depression," measured through a structured interview or self-report measure, and "depressive symptoms." We incorporate research that defines depression as a syndrome, disorder, and more broadly as internalizing disorders. Internalizing symptoms include withdrawal and somatic complaints and include significant overlap between depression and anxiety during development. Because anxiety and depression are highly comorbid, and one often precedes the other, we consider this joint study equally important in understanding depression alone.

Depression as a Disorder of Affect

Essential features of depressive disorders involve a depressed mood and a reduction in positive affect. As such, we consider depression as centrally an affective disorder and the understanding of an individual's emotional processing and regulation as key to its study. Emotion regulation is the goal-directed process of changing our emotions and their expression (Gross, 1998). This includes the decrease, increase, or maintenance of both negative and positive emotions. It involves both extrinsic and intrinsic processes for monitoring, evaluating, and modifying emotional responses. This emotional process encompasses cognitive facilities as well, as many regulatory strategies involve cognitive control or inhibition. The regulation of emotion is a skill that strengthens throughout life and facilitates the ability of emotion to guide adaptation (Thompson, 1991). Depression is increasingly being studied as a result of maladaptively regulating emotions (Watson, 2005). One's ability to regulate is strongly tied to their social experiences, particularly with caregivers (Thompson, 1991). Therefore, we must not only determine associations between depression and specific emotion regulation strategies but also how styles of emotion regulation develop as a function of childhood context.

A Developmental Framework

Historically, mental health research has been oriented toward adults. Original classifications of psychological disorders were meant for use in adult populations. As a result, categories of child psychopathology were often merely a downward extension of adult psychopathology, considered as clear analogs of adult disorders (Garber, 1984). However, children are constantly going through significant changes in cognition, social and emotional function, neural circuitry, and physiology. Depression, as a disorder intricately linked with each of these functions, presents differently across development. Furthermore, understanding trajectories of depression through childhood will help conceptualize mechanisms of adult depression. This is one line of thinking underlying developmental psychopathology, a field that studies the origins and course of maladaptive behaviors in an individual (Sroufe & Rutter, 1984).

This chapter utilizes a developmental psychopathology framework. Such an approach emphasizes both typical and atypical trajectories of development, and the ways in which they interact and diverge. By emphasizing the use of multiple levels of analysis, it encourages the study of change in all aspects of development, biological and psychological. The perspective considers every stage of life consequential, a potential moment for the strengthening of resilience or the divergence from a normative path to a maladaptive one (Cicchetti, 1993). Individuals from a range of origins may arrive at similar endpoints, a phenomenon known as equifinality. Meanwhile, individuals who experience very similar origins may find themselves experiencing a range of different outcomes, a phenomenon known as multifinality. Equifinality and multifinality point to the importance of process in understanding outcomes (Cicchetti & Rogosch, 1996). Rather than expecting direct causal relations, researchers are prompted to consider risk factors that may trigger or maintain pathways toward a disorder and protective factors that shield one from risk.

Since we often describe depression in terms of maladaptive emotional processes and behavior, we must distinguish how we conceptualize the term "maladaptive." A maladaptive pattern of behavior characterizes an individual who has developed symptoms known to have negative outcomes in a normative social context. Adaptive behaviors in one context may be maladaptive in a different context. For example, although hypervigilance is considered a maladaptive behavior often associated with childhood maltreatment (Rieder & Cicchetti, 1989), it likely serves protective functions in a context of danger. Ellis, Bianchi, Griskevicius, and Frankenhuis (2017) argue against a deficit model, in which high-stress environments result in learned behaviors that require remediation. They propose that we consider the unique strengths of children from high-risk backgrounds and their ability to specialize cognitive function to context (Ellis et al., 2017).

We recognize here that children who have experienced trauma or stress are not inherently broken or dysfunctional. We utilize the terms maladaptive, maladaptation, and dysfunction to signify a departure from the functioning of individuals who do not present with mental health conditions and a difficulty with behavior or cognition according to the standards of a low-risk environment. Further, we believe that the study of particular strengths emerging from risk fits within a developmental psychopathology framework, and continued research should examine adaptation in stress-exposed children (Masten & Cicchetti, 2016).

The Present Chapter: A Roadmap

Given our focus on multiple levels of functioning, we span a range of topics about childhood and adolescent depression and internalizing disorders. First, we provide a historical overview of depression. We discuss developmental timing of symptom onset and course and the impetus for understanding depression through a developmental lens. Then, we review predispositions associated with later depressive symptomatology, including temperamental traits, genetics and heritability, and underlying neurobiological and physiological processes. We consider social factors, outlining the importance of parenting, the socialization of emotion regulation in the family, and the role of cultural values. Outside of the home, we discuss the role of peer relations. Extreme experiences of early adversity, separable from normal variations in life experience, are described. Finally, the importance of prevention interventions is discussed, as well as the current state of behavioral and psychological treatment interventions. Throughout this chapter, we conceptualize the development of depression as closely linked with emotional development and regulatory capacity.

Historical Perspectives

The investigation of depression and its relationship to emotions has been in the forefront of philosophical and theoretical contemplation since the works of Hippocrates and Aristotle over 2000 years ago. Hippocrates theorized about basic bodily humors or the bodily fluids considered to cause human emotion. According to this notion, "black bile" was related to devastating illnesses such as cancer and depression. Hippocrates's description was a psychobiological theory at its heart, whereby different bodily "temperaments" were related to melancholia. Melancholia largely represented people who were characteristically gloomy, pessimistic, anxious, prone to hide or run away, sleepless, and apt to emotional outbursts. The Greeks further described certain personality traits and contextual experiences as contributing to the onset of depression (for a review, see Gilbert, 2017; Jackson, 1986). Additionally, Aristotle stated that effectively treating mental illness rested upon releasing repressed emotions and passions (Cicchetti, Ackerman, & Izard, 1995; Jackson, 1986). The idea that mood states underlie biological dysfunction has lingered in theory and science ever since.

While Hippocrates placed depression largely in the body, many other philosophers (e.g., Plato) believed that depression was a disturbance of the soul. This led to concerns about depression representing some form of immoral living. Stigmatizing orientations such as these have dominated religious and cultural beliefs throughout time (Jackson, 1986). Kraepelin took the study of melancholia – although conceptualized differently – back into the hands of doctors during the latter half of the nineteenth century. In his Kraepelinian system, psychiatric disorder, emotions, thoughts, and behaviors were all seated in the brain. Through the work of Charcot and Freud, the etiological factors of disorders such as depression entered the conversation. Debates over the last century have focused on exogenous (external) versus endogenous (internal) etiologies of depression as well as the categorical and dimensional nature of the disorder. There have been many attempts to create accurate approaches to classifying the disorder (for a review, see Gilbert, 2017).

Mood disorders of children and adolescents have been investigated for a shorter period of time and at much less depth. However, observa-

tions of depressed mood in children can be found as early as the seventeenth century. By the nineteenth century, case studies describing depressed children were being published by notable clinicians such as Levy, Anna Freud, Bierman, Harrington, Hassan, and Burlingham. Children were described as experiencing extreme persistent grief, looking sad, crying, presenting with flat affect, irritability, loss of appetite, lack of energy, and difficulty with life tasks (Kashani et al., 1981). During the 1960s, a proliferation of interest and debate about the reality of depression in children emerged (e.g., Rie, 1966). By 1970, the concept was largely accepted and was the leading topic at the National Institute of Mental Health by 1975. This was even further bolstered by the growing belief that factors during childhood were contributing to adult-onset depression. Understanding the developmental process giving way to depressive symptoms became essential and increased the probability that at least some substrate of depression could occur in childhood (Akiskal & McKinney, 1975). At first, the field primarily focused on understanding and creating the epidemiological and diagnostic criteria for child mood disorders. Investigations have moved on to understanding the causes, symptom course, sequential comorbidities, and treatment responses (Kashani et al., 1981). To fully comprehend the complex nature of childhood depression, there must be an understanding of the process by which depressive psychopathology can take hold. Cicchetti and Schneider-Rosen (1986) suggest an organizational approach to childhood depression to take on the challenge (Cicchetti & Schneider-Rosen, 1986).

The Organizational Approach

The organizational approach to psychopathology defines development as a systematic structural reorganization of cognitive, affective, biological, and social systems of behavior (Cicchetti & Schneider-Rosen, 1984b). According to Werner (1948), these systems reorganize via differentiation and hierarchical integration. The reorganization theoretically represents an increased role of complexity and effective organization of the system and subsystems (Werner, 1948). Given this conceptualization of depression, psychopathology may be best understood as the failure to achieve competence within one system or the inability to meet a developmentally stage-salient goal. Unfortunately, depression in children – since its integration into the DSM-III (American Psychiatric Association, 1980) – has been diagnosed with the same and/or very similar criteria to that of adults. This is problematic, because there may be age-appropriate limitations to child cognition, emotional, and social development. Understanding the nuances between what is normal and abnormal across time is challenging and something that the organizational perspective tries to conquer. Further, the organizational approach is particularly interested in the biological reorganization and integration of competencies within context, as they relate to the development and conceptual understanding of psychopathology (Cicchetti & Schneider-Rosen, 1984b). This tenet has been carried forward in the developmental psychopathology discipline, which now emphasizes the role of multiple levels of analysis in understanding the developmental picture of disorders, including depression. These views are further substantiated by a current wealth of empirical literature, outlined in this chapter.

The Developmental Psychopathology Perspective

The developmental psychopathology perspective began to emerge as a distinct discipline in the 1970s, drawing upon embryology, developmental psychology, neuroscience, experimental psychology, and the clinical psychological sciences. These disciplines have historically been theoretically and scientifically distinct. In particular, at the time, there was a clear divide between academic psychologists who did not study emotions and clinicians who did not study cognition (Cicchetti, 1984).

Developmental psychopathology and the emergence of medical models of psychopathology instigated a theoretical convergence (Engel, 1977). It became broadly accepted that a wide array of factors (genetic, psychological, environmental, etc.) may play a role in the development of mental disorders. It is now also widely accepted that pathological conditions should be studied in concurrence with basic research on human functioning (Cicchetti, 1984). One of the central tenets of developmental psychopathology lies in its understanding that more knowledge about normative development can be deduced by studying psychopathology, and more about pathology can be understood by studying normative processes. This idea finds its clearest roots in the works of Sigmund Freud (e.g., 1927/1955), Erikson (1993), Anna Freud (e.g., 1966), Goldstein (e.g., 1940), and Werner (e.g., 1948). Largely, these developmental theorists believed that pathology was a distortion of normative processes (Cicchetti, 1984).

The developmental psychopathology view has led to the reintegration of emotion and emotion regulation into an academic conceptualization of depression. This perspective allowed scientists to understand that the investigation of emotions has an important role in understanding both normal and abnormal development. This role includes distinguishing between well-adjusted and maladaptive emotional development (Cicchetti et al., 1995). Current theory tends to look at the development of depression from a translational and developmental perspective. However, it is important to remind scientists that development extends across the life course, and thus depression unfolds over time in a dynamically developing organism. A number of abnormalities and risk factors exist, and they do not exist in isolation. Instead, they are interrelated and mutually dependent. Science must move beyond identifying singular level contributions and toward a multidisciplinary and biopsychosocial approach. Independent views coming together will enhance our understanding about how differences evolve across development and what organizational processes lead to psychopathological symptoms (Cicchetti, 2016; Gilbert, 2017).

Cognitive-Behavioral Models of Depression

Although we place emphasis on emotional theories in this chapter, cognitive and cognitive-behavioral theories have been formative in the research and treatment of depression. Beck (1967) and Beck, Rush, Shaw, & Emery (1979) provided a cognitive model of adult depression which suggests that those prone to depression have latent distorting negative schemata. After it is activated through the experience of a stressful situation, there is a negative view of the self, world, and the future. Additionally, Beck reasons that depressed individuals have cognitive distortions that represent systematic errors in reasoning (Beck, 1967; Beck et al., 1979). However, it is important to note that some research suggests the opposite of this model that depressed individuals may not distort information but rather perceive the world more realistically (Alloy & Abramson, 1979).

Another notable cognitive theory of depression is the learned-helplessness model, in which an individual no longer believes that their behavior can influence the environment and so stops trying. Once an outcome is believed to be uncontrollable, he or she has diminished self-esteem and displays diminished cognitive problem-solving capacities (Seligman, 1975). A revised version of the theory emphasized explanatory style or the manner in which a person explains causal factors in their lives. If a person's style is characterized by an internal, stable, and global attribution for negative outcomes, they have an increased risk for depression (Abramson, Seligman, & Teasdale, 1978). A decade later, this model was further revised to incorporate a diathesis-stress model, in which attributional styles are mediators between stressful life events and depressive outcomes. In this iteration, explanatory style is distal and hopelessness is proximal and sufficient to cause depression (Abramson, Metalsky, & Alloy, 1989).

These constructs have been translated to the developmental literature, which suggests that depressed youths have more distorted cognitions, low self-esteem, increased feelings of hopelessness,

and deficits in instrumental responding associated with learned helplessness. Research suggests that depressed youth have more internal, stable, and global attributions for negative events. There are also apparent deficits in self-monitoring, self-evaluation, and self-reinforcement (for a review, see Kaslow, Brown, & Mee, 1994).

Developmental Timing of Depression Onset

Each developmental period consists of new challenges to master new stage-salient tasks. These stages build on each other, creating potential lifelong adaptive challenges. For example, the existence of the attachment relationship emerges in the first year of life and can have subsequent impact on the successful acquisition of new developmental tasks, such as autonomy or being connected to important others (Sroufe, 1979). Given that depression often emerges in adolescence or early adulthood and has a strong likelihood of recurrence, it is essential to understand how the timing of depression onset denotes vulnerability to subsequent depressive episodes and/or opportunities for resilience.

Developmental Differences in Symptomology

Depressive symptoms are thought to manifest in markedly different ways across development. Symptom profiles of depression are constrained by developmental maturity across numerous domains including cognition, language, memory, and self-understanding (Cicchetti & Toth, 1998). For example, young children (i.e., preschoolers) do not report depressed mood or hopelessness because they do not yet possess the cognitive skills to understand or express those symptoms. Instead, younger children typically have more somatic complaints and experiences of hypersomnia. The rates of these symptoms decrease with age. Conversely, depressed mood, psychomotor problems, and anhedonia are seen at higher rates in adolescence, and the occurrence of these symptoms increases with age from childhood to late adolescence (Hankin, 2017). These variations in symptoms are a challenge to DSM-5 diagnostic criteria, which include only minimal differences between childhood and adulthood MDD and persistent depressive disorder (dysthymia; American Psychiatric Association, 2013). Although there are steps toward developmentally appropriate perspectives, there is space for greater sensitivity to developmental variations in symptom manifestation, especially for young children (i.e., 6 years and younger).

Since it was initially suggested in reports in the 1900s, there has been resistance to the application of psychiatric diagnoses to preschool-aged children. These concerns stem from the fear that a clinical diagnosis may pathologize normal behaviors in emotion expression and place unnecessary stigma on children. This reluctance may also be related to societal expectations that childhood – particularly early childhood – should be a carefree and happy period. Regardless, current work finds depressive symptomology in children as young as 3 (Stalets & Luby, 2006).

Studying psychopathology in young children is undeniably complicated, but incorporating developmental considerations may ease these concerns. Preschool is a time of rapid cognitive and emotional development and contextual change (e.g., placement in formal school programs), during which there are increasing parental expectations for autonomy. It is not uncommon for children in this age range to display behavioral and emotional difficulties. Understanding the line between normative variation and clinically relevant divergence is difficult. The current diagnostic system requires a significant change to productivity and life satisfaction, criteria that can be hard to note for children too young to hold comparable responsibilities. Several suggestions for changes to diagnostic criteria have been made. For example, evidence of impairment can include deficits in facial affect recognition and visual spatial skills, and social and emotion regulation failures that are markedly below what would be expected for children of a similar age. Stalets and Luby (2006) noted that 93% of preschoolers who met diagnostic criteria in the Preschool Age Psychiatric Assessment Test Retest Study were impaired by these criteria.

Additionally, young children typically have more fluctuations in mood, making it hard for children to meet the 2-week criterion for depressed mood (Stalets & Luby, 2006). Setting aside this criterion may be helpful in denoting depression in young children. Further, it may be important to include additional observable traits as diagnostic criteria that are consistent with developmental stage, such as young children using death-themed play. Refining the nosology of depression could vastly improve our ability to accurately estimate and identify preschool and preadolescent depression.

Adolescence represents a unique time when an individual is neither a child nor an adult. It is characterized by a lengthy transitory phase full of neurobiological, hormonal, psychological, and social system changes. This period is thought to increase the potential for both internal and external sources of conflict that are concurrent with increases in depressed mood. Adolescents often face mood disruptions and participate in increased risk taking, with an associated increase in internalizing and externalizing forms of psychopathology. Changes in functioning across systems are interrelated and mutually interdependent. Current research is working to tease apart the developmentally normative transitions in affect perturbation compared to those that are pathological in nature (for a review, see Cicchetti & Toth, 2009).

Developmental Epidemiology

The developmental epidemiology of depression has been examined in many studies with different age groups, methods, and samples. At the syndrome level, about 20–50% of adolescence report significant symptoms of depression (Petersen et al., 1993). Self-report prospective studies suggest that the average level of depressed mood and symptoms rises from low levels in childhood to much higher levels by the middle of adolescence (Hankin, 2017). Cross-sectional and longitudinal studies of clinical depressive disorders reflect those trends, suggesting that young children have low lifetime prevalence rates (<3%) and adolescents experience increases in lifetime prevalence to about 17% by age 18 (Merikangas et al., 2010). Gender differences also begin to emerge in adolescence, as a greater number of females than males report depressive episodes (Hankin, 2017). Children and adolescents typically experience a depressive episode for about 32 weeks, with maximum recovery of about 92% by 18 months. Adult prevalence rates – similar to those in late adolescence – remain stable at approximately 18.3% until after age 65, when they drop to 6.8%. Adults have similar episode durations to children, but the majority of individuals typically recover in 6–12 months (Garber, 2000). In general, lifetime prevalence of MDD sits at about 14.4% (Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012).

It is essential to note that elevated rates of depressed symptoms in children and adolescence do not represent normative developmental changes. The consequences of depression during childhood and adolescence cannot be minimized, nor do they embody typical teenage "moodiness." Depressed disorders are not simply short-lived problems that dissipate with time. Even when a depressive episode remits, it can impede child functioning and development (Cicchetti & Toth, 1998). Depressed mood at young ages carries an increased risk for the development of depressive disorders later in life. However, continuity from childhood into adulthood is weaker than is continuity from adolescence into adulthood. Approximately 80% of adults experience another episode of depression 5–7 years after their first episode. Nevertheless, recurrence in youth remains a cause for concern. Approximately 40% of youth who experience a depressive episode will experience another episode over the following 3–5 years (Hankin, 2017).

While these patterns in depressive symptoms have been largely represented in the literature, assuming a common trajectory across all individuals is limiting. In an attempt to understand risk factors associated with higher levels in depressive symptomology across the life course, Costello, Swendsen, Rose, and Dierker (2008) used semi-parametric group-based modeling to identify trajectories of depression from adolescence to adulthood. Four distinct trajectories were identified: no depressed mood, stable low,

early high declining, and late escalating. Baseline risk factors associated with membership in a depressed mood trajectory compared to the non-depressed group included being female, an ethnic minority, low socioeconomic status, using substances, and engaging in delinquent behavior. Baseline protective factors were also noted and included having two parents; feeling connected to parents, peers, or schools; as well as having high self-esteem (Costello et al., 2008).

There are multiple developmental processes that may explain differences in prevalence across time. In adolescence, theories include puberty-related hormonal changes (Copeland et al., 2010; Mendle, Harden, Brooks-Gunn, & Garber, 2010); adolescents' increased ability for abstract thinking, self-reflection, and rumination in line with their increased cognitive abilities (Hankin, Snyder, & Gulley, 2013); changing social relationships (Hankin, Mermelstein, & Roesch, 2007); increases in noncontrollable negative events (Hankin, 2017); and developmental changes in children's experiences and expression of emotions (Silk, Steinberg, & Morris, 2003). In addition, depression is estimated to have lower lifetime prevalence among older adults (ages 65+) compared to adults in the age range of 18–64. This could represent a genuine decrease in prevalence, a genuine increase in lifetime prevalence of disorders among adults in more recent generations, or early mortality or morbidity related to history of mental disorders which makes it impossible to participate in survey or exclude (Kessler et al., 2012). Empirical evidence has supported the relationship between mental disorders and physical disorders (Scott et al., 2009) as well as mortality (Lefèvre et al., 2011).

Patterns of Sequential Psychiatric Comorbidities and Transdiagnostic Factors

Depression and other psychiatric disorders commonly co-occur, and an estimated 40–70% of depressed children and adolescents have a comorbid disorder (Cicchetti & Toth, 1998). Depression occurs more often than chance alongside anxiety disorders, behavioral disorders, attention deficit hyperactivity disorder (ADHD), and substance use disorders. Young children with depression are likely to have a co-occurring separation anxiety disorder, and adolescents are likely to have an eating or substance use disorder (Hankin, 2017). Co-occurring disorders also raise questions about patterns of sequential psychiatric comorbidity or whether one disorder predisposes individuals to risk for another. Given the overlap, interest in transdiagnostic factors (i.e., clinical features that contribute to multiple diagnoses) has surged (Aldao, Nolen-Hoeksema, & Schweizer, 2010).

Anxiety Disorders

Anxiety has been found to precede later depression in many studies (e.g., Kim-Cohen et al., 2003). However, others have found the reverse pattern (Moffitt et al., 2007). Similar inconsistent patterns are present in the relationship between depression and externalizing behaviors (e.g., Kim-Cohen et al., 2003; Wolff & Ollendick, 2006). The extant literature suggests three possible developmental patterns: (1) anxiety/externalizing disorders precede depression, (2) the disorders occur simultaneously, or (3) depression precedes anxiety/externalizing disorders (Hankin, 2017). There has also been increased interest in transdiagnostic work looking at the link between depression and anxiety via elements of affect, attention, memory, reasoning, thought process (specifically rumination), and behaviors (McLaughlin & Nolen-Hoeksema, 2011). Future work on transdiagnostic patterns and developmental patterns is needed. It will be particularly interesting to differentiate among developmental patterns by different ages of symptom onset, various environmental stimuli, as well as different specific patterns of symptomology within each disorder.

Substance Abuse and Self-Medication

Substance use and depression are two of the most commonly occurring and commonly emerging disorders in adolescence and early adulthood.

Research with clinical and community samples has found consistent relationships between substance use and depression. For example, during initial clinical observations, depressed youths report more drug and alcohol use than their non-depressed counterparts. Lifetime prevalence rates for illicit drug use (excluding marijuana) occurred in more than 67% of patients and in only 8% on non-depressed youth. Substance use and depressed mood co-occurred commonly among a community sample of adolescents (for a review, see Piacentini & Pataki, 2016).

Scientists have struggled with understanding the timeline of the relationship between substance abuse and depression due to many overlapping and co-occurring symptoms. Both depression and substance abuse often result in sleep and appetite disturbances, apathy, agitation, trouble concentrating, and fatigue. The etiological relationship between substance abuse and depression most likely exists along three developmental pathways.

The first pathway suggests that substance abuse develops in response to preexisting depression. The self-medicating hypothesis of addiction (Khantzian, 1997) suggests that individuals turn to substance use and abuse to help manage various physical or mental symptoms. Similar models, such as the negative reinforcement withdrawal model (Wikler, 1948), suggest that the primary motivator for drug use is avoiding negative emotional states. In laboratory and clinic settings, negative affect is related to increased cravings (e.g., Stewart, 2000; Wheeler et al., 2008), and higher substance use relapses rates (Conner, Sorensen, & Leonard, 2005; Kodl et al., 2008). Generally, depressed adolescents have a more stable pattern of substance use than their non-depressed counterparts. As decreases in self-esteem are seen over time, there are notable increases in the initiation of drug use. The experience of depressive symptomology was linked to reinitiating drug use following abstinence (e.g., Curran, Booth, Kirchner, & Deneke, 2007), a pattern which may be particularly strong for specific substances. Depressive symptomology during childhood and adolescence is related to increased risk for alcohol dependence, earlier onset of alcohol, and higher alcohol consumption in adulthood (Pedrelli, Shapero, Archibald, & Dale, 2016).

The second pathway suggests that substance use plays a role in the etiology of future depressive symptoms. In fact, persistent substance use is known to disrupt neurotransmitters central to affective states and stress regulation. In particular, substance use is related to changes in the dopamine and serotonin systems in the nucleus accumbens and increases in corticotropin-releasing factor in the central nucleus of the amygdala (Weiss, 2005). These hypotheses are further bolstered by observational studies. Some studies find that 78% of cases of substance use disorder preceded or were concurrent to the onset of depression (Piacentini & Pataki, 2016). Higher frequency alcohol use in early adolescence is associated with depressive disorders later in life. Adolescents who met criteria for alcohol use disorder in early adolescence were two times more likely to meet criteria for depression in late adolescence and early adulthood than their non-diagnosed counterparts. Subthreshold alcohol users were 1.5 times more likely to be diagnosed with depression. A meta-analysis of alcohol use frequency found positive linear pattern such that increases in alcohol use were related to increased risk for depression (Repetto, Zimmerman, & Caldwell, 2004). However, there is also evidence against heavy drinking during adolescence predicting adult depression (for a review see Pedrelli et al., 2016).

The third pathway suggests that substance abuse and depression may occur concurrently. Merikangas et al. (1985) has proposed that depression and substance abuse can emerge due to similar social risk factors (Merikangas, Leckman, Prusoff, Pauls, & Weissman, 1985). For example, the number of adverse childhood experiences a person has endured is related to increases in depressive symptoms and substance use, such that an increased number of experiences is related to greater risk for both outcomes (Mersky, Topitzes, & Reynolds, 2013). It is possible that the experience of early life stress may disrupt biological symptoms associated with maladaptive affect regulation and behaviors

related to both depression and substance use. More information about the effects of life stress on the development of depression is discussed later in this chapter.

Although it is clear that a relationship between depression and substance use exists, the nature of that relationship is still uncertain. It is most likely that there is no singular answer to explain the relationship. Different patterns may emerge dependent on a host of individual factors and environmental experiences. For physicians, understanding who is at increased risk for experiencing these comorbid disorders may be central to devising a treatment plan. Substance use and depression tend to exhibit similar symptoms, and direct screening for concurrent substance use is recommended.

Non-suicidal Self-Harm

Self-harm is commonly defined as deliberate and voluntary self-injury that is not life-threatening and exists without any conscious suicidal intent (Borges, Anthony, & Garrison, 1995). Self-harm behaviors include cutting, hitting, biting, punching, pinching, burning, and ingesting pills. The prevalence and recognition of this behavior have increased such that the DSM-5 proposed that non-suicidal self-injury be included as a new diagnostic entity. Studies using the proposed diagnostic criteria report 4–7% of community adolescent samples, and up to 50% of child and adolescent psychiatric samples engage in self-injury behaviors (for a review, see Plener, Kapusta, Brunner, & Kaess, 2014). A systematic review of literature found that generally, self-harm behaviors increase in young adolescence and decrease in late adolescence/young adulthood, reaching a peak between 15 and 17 years old. Past self-harming behaviors, depressive symptomology, and female gender have been reported as predictors for self-harming behaviors (Plener, Schumacher, Munz, & Groschwitz, 2015).

Considerable empirical work is centered on the motivating factors behind participating in self-harm. Despite the common conceptualization that self-harming behaviors are primarily motivated by attention seeking and manipulative behaviors, much evidence also suggests the role of affect regulation (Shepperd & McAllister, 2003). Clinical adolescent and adult samples suggest that salient motivations are as follows: to express, reduce, or distract from loneliness, depression, or emptiness; to release anger or tension; to punish oneself; to regain control; and/or to detach (Osuch, Noll, & Putnam, 1999; Rodham, Hawton, & Evans, 2004; Suyemoto, 1998). Current theories have been primarily focused on self-harm behaviors as a coping strategy for reducing extreme negative affect or to terminate states of dissociation and depersonalization – states common in depressed patients (Laye-Gindhu & Schonert-Reichl, 2005; Nixon, Cloutier, & Aggarwal, 2002; Ross & Heath, 2003). Self-harmers tend to report high levels of negative affect, further bolstering the hypothesis that self-harm is a coping mechanism used for emotion regulation (Nixon et al., 2002). However, the reported role of these behaviors may function differently depending on gender, whereby boys report more externalizing and interpersonal motivations and girls report internalizing and intrapersonal motivations (Compas, Orosan, & Grant, 1993; McMahon, Grant, Compas, Thurm, & Ey, 2003).

Associations have been found between self-harm and various diagnoses of psychopathology, including anxiety disorders and bipolar personality disorders. Self-harm behaviors have also been associated with depression and low self-esteem in adults and children (Claes, Klonsky, Muehlenkamp, Kuppens, & Vandereycken, 2010; Darche, 1990; Ross & Heath, 2003; Selby, Bender, Gordon, Nock, & Joiner Jr, 2012). Interventions targeting depressed children and adolescents should screen for these behaviors and focus on alternative emotion regulatory strategies to decrease the inherent physical harm associated with self-harm and substantial increased risk for suicide (for a review, see Andover, Morris, Wren, & Bruzzese, 2012).

Suicidal Ideation and Suicide

Youth suicide is the second leading cause of death among adolescents 12–19 years old and is accompanied by a 50-fold increase in suicide rates compared to their 5- to 11-year-old counterparts. Adolescence marks the developmental period in which suicide is most frequently attempted, with each attempt increasing risk for both future attempts and death (Centers for Disease Control and Prevention, 2010). However, suicide still represents a leading cause of death among children 5–11 years old (Centers for Disease Control and Prevention, 2014). From 1993 to 2012, a total of 657 children aged 5–11 years in the United States died from suicide. There was no significant change in the overall suicide rate from 1993 to 2012, but suicide rates among black children increased while rates among white children decreased. Additionally, boys committed suicide more than girls (84% and 16%, respectively; Bridge et al., 2015). Understanding trends in suicide rates and how they vary by various demographic characteristics (e.g., race, age, SES, etc.) may be important in tailoring future interventions and screening for potential risk.

MDD is particularly related to increased risk for suicide behaviors in children and adolescence (Goldston et al., 2009). Depression is often identified as the single best predictor of suicidal ideation (Barzilay et al., 2015; Barzilay & Apter, 2014; Evans, Hawton, & Rodham, 2004). Symptoms common in depression were also found to be related to suicidal ideation and attempts. Hopelessness, sleep problems, feeling tired, impaired self-esteem, and unhealthy eating behaviors have all been associated with both depression and suicidal phenomena. Both have also been related to maladaptive behaviors discussed in this section – such as smoking, drinking, and self-harm behaviors – as well as environmental factors. Environmental factors that contribute to increased suicide rates among adolescents include emotional aspects of parental relationships, marital conflict between parents, socioeconomic status, and physical abuse (for a review, see Evans et al., 2004). Suicidal behaviors and its relationship to depressive symptomology are complex and probably emerge from a multitude of interacting factors listed above.

Considering the widespread prevalence, treating and preventing adolescent depression and suicide is a top concern for current public health officials. Utilization of upstream interventions through public social systems has the most potential for reducing suicide rates among children with emotional and behavioral problems. Suggested targets include emotional and behavioral self-regulation abilities and increasing social cohesion and connectedness in families and communities (Wyman, 2014). However, attempts to treat childhood and adolescent depression must be approached cautiously, as some antidepressant medications have been known to increase chances for suicide behaviors (Hammad, Laughren, & Racoosin, 2006; Leslie, Newman, Chesney, & Perrin, 2005).

Temperament

One of the most salient predisposing factors for childhood depression is temperament. Temperament is broadly defined as a variety of individual differences in emotional and behavioral reactivity and regulation which appear early in life and are relatively consistent over time. Temperament plays a key role in the development of social and emotional functioning across the lifespan and sets the stage for the emergence of core adult personality traits. It is believed to be heritable and biologically based, but modifiable by environmental experiences. Specific categorization of temperamental characteristics has been heatedly debated, but analyzing higher-order temperamental traits appears to be the most promising for understanding the development of depression in children and adolescents (Compas, Connor-Smith, & Jaser, 2004; Shiner et al., 2012). These broader constructs include positive emotionality, negative emotionality, and effortful control (Compas et al., 2004).

Positive emotionality reflects the extent to which a child is receptive to rewarding stimuli, is sensation seeking, and is actively engaged in his

or her environment. This is theorized to be related to the Behavioral Activation System (BAS), a neurological network sensitive to reward, goal approach, and frustration in unrewarding situations. Negative emotionality – often referred to as "difficult" temperament or behavioral inhibition – is related to fear, anger, sadness, low soothability, and general discomfort. The neurological basis for negative emotionality, the Behavioral Inhibition System (BIS), is related to threat sensitivity, vigilance, heightened emotional and physiological arousal, and restricted behaviors. The third construct, effortful control, represents the effortful control of emotions, behaviors, self-regulation, attention, and task persistence. Effortful control can modulate both the expression of positive and negative emotionality (Compas et al., 2004).

Defining temperament is made yet more complicated by the integration of personality constructs, historically used to categorize relatively stable individual traits in adults, to describe traits (Mervielde, De Clercq, De Fruyt, & Van Leeuwen, 2005). In the Five-Factor Model, personality dimensions are defined as Extraversion (versus introversion), Agreeableness (versus antagonism), Neuroticism (versus emotional stability), Conscientiousness (versus negligence), and Openness (versus closedness). Temperamental dimensions show clear correspondence to adult personality dimensions. The correspondence is a sequential relationship whereby temperament serves as the affective, activation, and attentional core to which personality traits develop. The interaction between temperament and environmental influences is predicted to produce personality traits which are theorized to represent a wider scope of individual traits including thoughts, skills, values, defenses, morals, beliefs, and social cognitions (De Pauw & Mervielde, 2010).

Temperament and Increased Risk

Temperament and its biological correlates have direct implications for understanding the development of depression in children, adolescents, and even adults. Robust findings suggest that depression is related to negative emotionality both concurrently and prospectively. Negative emotions are thought to heighten autonomic activity and narrow attention to threatening or negative stimuli (Sherman, Vousoura, Wickramaratne, Warner, & Verdeli, 2016; Southwick, Vythilingam, & Charney, 2005). Negative emotionality or difficult temperament has also been related to the severity of symptoms such that difficult temperament predicted more recurrent major depressive episodes as well as increased episode severity and life disruption (Sherman et al., 2016). However, negative emotionality has also been correlated with other disorders such as anxiety (Ormel et al., 2013). The tripartite model of anxiety and depression (Clark & Watson, 1991) differentiates the two by suggesting that low positive affect is specific to depression, while physiological hyperarousal is specific to anxiety disorders. Low positive emotionality is especially related in the context of high negative emotionality, mapping almost directly onto the dysphoric and anhedonia symptoms of depression (Compas et al., 2004). A combination of high negative emotionality, low positive emotionality, and low effortful control constitutes the highest temperamental risk for depression (Vasey et al., 2013). However, the tripartite model may not work similarly across all anxiety and depression diagnoses (Anderson & Hope, 2008).

The Five-Factor Model of personality traits has also contributed to our understanding of adult psychopathology. Symptoms of clinical disorders are typically associated with high neuroticism, low conscientiousness, low agreeableness, and low extraversion (De Pauw & Mervielde, 2010; Malouff, Thorsteinsson, & Schutte, 2005). There may also be interaction effects whereby children who are high in neuroticism are prone to exhibit an automatic attentional bias to threat, but that bias can be diverted if children have high levels of effortful control (De Pauw & Mervielde, 2010).

The majority of temperament work is cross-sectional in nature, making the direction of the relationship between temperament and depression unclear. Multiple theories about their association have been derived: (a) the *vulnerability*

model suggests that specific temperamental traits place an individual at risk for developing depression; (b) the *continuity model* suggests that depression represents the extreme ends of a temperamental trait; (c) the *pathoplasty model* represents temperament as shaping the course of a disorder by making specific symptoms more likely; (d) the *scar model* hypothesizes that personality and temperament characteristics change as a result of experiencing depression; and (e) the *differential susceptibility model* is an extension of the vulnerability model in which those most at risk for developing depression based on temperament are also those that reap the most benefits from environmental support and enrichment (Belsky, Pasco Fearon, & Bell, 2007; Compas et al., 2004; Nigg, 2006). Further, theoretical papers have attempted to blend the differential susceptibility model with the biological sensitivity to context model, which both agree that some individuals are more susceptible/sensitive to both negative and positive experiences (Ellis, Boyce, Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2011).

It is highly likely that there is no one correct answer for how temperament and depression are related. Empirical work has reinforced all of the above hypotheses. Longitudinal prospective studies generally support the vulnerability model where specific traits predict depressive symptoms above and beyond initial mental health symptoms (Laceulle, Ormel, Vollebergh, Aken, & Nederhof, 2013; Rosenström et al., 2014). The continuity hypothesis has been supported by correlational patterns between temperament and psychopathology traits (De Pauw & Mervielde, 2010). The pathoplasty model has garnered support but has been conceptualized in a variety of ways. Some test the model as an extension of the continuity hypothesis in which a change in temperament predicts changes in psychopathology (Laceulle, Ormel, Aggen, Neale, & Kendler, 2013). The pathoplasty model has also been conceptualized as temperament altering the expression of psychopathology once it already occurs (Nigg, 2006). There has been inconsistent support for the scar model in which temperament is changed by the experience of depression. Some studies denote personality changes based on the experience of depression, others do not (De Bolle, Beyers, De Clercq, & De Fruyt, 2012; Rosenström et al., 2015; Shiner, Masten, & Tellegen, 2002).

Finally, the differential susceptibility model has received a great deal of attention over the last decade. This model has primarily been tested by looking at how variations in temperament are related to psychopathology based on the experience of risk, adversity, and different parenting styles (Abulizi et al., 2017; Sherman et al., 2016). Importantly, these studies look beyond negative contexts to examine how supportive environments may promote positive outcomes. Continuing support for the model suggests that efforts to improve environmental conditions may ultimately change mental health outcomes for those also most susceptible to negative outcomes (e.g., Sherman et al., 2016). However, not all findings are consistent (e.g., Abulizi et al., 2017). In line with a biological sensitivity to context perspective, there has also been attention to how differences in genetic variations can make an individual more or less susceptible to environmental experiences (Belsky & Pluess, 2013).

Current work often fails to think about changes in temperament and personality across development that may influence risk for psychopathology. Typically, research relating temperament and psychopathology treats temperament as a stable characteristic. Although temperament is relatively constant across time, empirical work also suggests that changes in temperament are normative (Caspi, Roberts, & Shiner, 2005; McCrae et al., 2000). Environmental influences can shape and change individual characteristics overtime. Many view adolescence as a particular time for major changes in temperament (Klimstra, Akse, Hale III, Raaijmakers, & Meeus, 2010). Adolescence is also the time in which substantial increases in depression occur (Avenevoli, Swendsen, He, Burstein, & Merikangas, 2015). So far, only a few studies to our knowledge have addressed this issue and have found that changes in temperament/personality appear to predict internalizing symptoms. One study found that adolescents who were

introverted at age 11 and became more extroverted at age 16 had decreases in internalizing symptoms. The adolescents who went from more extroverted to more introverted showed increases in internalizing symptoms (Akse, Hale III, Engels, Raaijmakers, & Meeus, 2007). Further, Laceulle, Ormel, Vollebergh, et al. (2013) found that change in effortful control from age 11 to 16 predicted internalizing disorders at age 16. When looking at diagnosed individuals, the association between change in temperamental traits (fear, frustration, and effortful control) and internalizing disorders was driven by participants diagnosed with MDD. These findings suggest that it may be important to understand how trajectories of change in individual traits influences risk for depression (Laceulle, Ormel, Vollebergh, et al., 2013).

Temperament and Resilience

Specific temperament profiles can signify risk for the development of depression or indicate a reduced risk for depression or resilience given specific environmental risk factors. It is important to study these characteristics, as it may provide empirical evidence for specific intervention targets. Low negative emotionality and high temperamental sociability could act as protective factors against the development of psychopathology. Sociability, the preference to be around others rather than alone, is related to the high levels of extraversion. This may function as a protective factor by allowing children to derive support from external sources in stressful situations (Janson & Mathiesen, 2008).

Additionally, high positive emotionality is related to lower risk for depression. High positive emotions and optimism are often related to greater life satisfaction, better mental health outcomes, and overall well-being. Positive emotions decrease autonomic arousal and broaden the ability to focus attention with creativity and flexibility. This is theorized to result in an expansion and improvement of coping mechanisms such as increases in positively reappraising situations, more goal-directed problem-solving, and remembering events with positive connotations. These tendencies may broaden physical, psychological, cognitive, and social abilities, thus protecting children from the development of depression (Southwick et al., 2005).

Temperament also may moderate the relationship between risk factors typically associated with risk for depression. For example, children of a depressed parent – a known environmental and genetic risk factor for depression – showed reduced risk for depression if they also displayed high levels of positive emotionality (Davis & Suveg, 2014; Masten, 1986). Tendencies toward humor have also served as protective factors in the context of risk (Southwick et al., 2005). By studying these and other traits, we may be able to further narrow down targets for prevention efforts.

Methodological Concerns and Future Directions

The outlined work on temperament provides a promising basis for further research on the relationship between child temperament and the development of depression. First, the constructs and syntax used to describe childhood temperament and personality need to be streamlined. Not enough overlapping work with shared methods exists to come to confident conclusions about these relationships (De Pauw & Mervielde, 2010). There also are concerns about shared methods variance, suggesting that parents reporting on both child temperament and behavioral depressive symptoms is problematic because relationships could emerge solely based on reporter biases (Kagan, Snidman, McManis, Woodward, & Hardway, 2002). Additionally, there is potential overlap in what temperament questionnaires and depression inventories are measuring (Lengua, West, & Sandler, 1998). Dougherty, Klein, Durbin, Hayden, and Olino (2010) addressed this issue by deleting overlapping items based on expert ratings. After overlapping items were removed, the negative relationship between positive emotionality and

depressive symptomology remained, suggesting that the relationship is not solely due to similarities in measurement (Dougherty et al., 2010).

Finally, it appears that temperament alone is insufficient to account for the full emergence of psychopathology. Rather, vulnerable temperament in addition to environmental experiences accounts for etiological risk. A deeper understanding of the moderators and interaction effects leading to the development of depression is needed. Further, work comparing temperament and developmental psychopathology is often cross-sectional in nature rather than longitudinal. This limits the ability to interpret the direction of the relationship and to analyze the effect of changes in temperament across time (Akse et al., 2007; Laceulle, Ormel, Vollebergh, et al., 2013). Future work should explore the effect of change in temperament across time as well as the interaction between change and environmental risk. It would be equally beneficial to explore how these trait level characteristics and relationship promote resilience to the development of depression (e.g., humor, sociability, positive emotionality).

Genetic Correlates

Heritability of Depression

Depression is a complex disorder that arises from both genetic and environmental influences. However, it is often considered a "familial disease" that has an estimated genetic heritability of ~40%. Meta-analyses suggest a staggering consistency in these heritability estimates across family and twin studies [95% confidence intervals 31–42%] (Sullivan, Neale, & Kendler, 2000). Current studies estimate that children of depressed parents are up to four times more likely to have an episode of depression than children of parents with other psychological conditions (Rice, Harold, & Thapar, 2002).

The prevalence rates of depression often vary by developmental age, with increases in incidences throughout adolescence and young adulthood. The interplay between changing environmental and genetic influences emerging across development is theorized to be the precipitating factor at play. Cross-sectional analyses of large epidemiological twin studies suggest that new genetic influences emerge in adolescence that are not accounted for by new shared environmental factors (Scourfield et al., 2003). Heritability risk for these children increases with age and reaches a probability of almost 70% in adolescence (Hammen, Burge, Hamilton, & Adrian, 1990). Further, epidemiological studies of depression have consistently shown a higher prevalence for women (Kendler, Gardner, Neale, & Prescott, 2001; Kendler, Gatz, Gardner, & Pedersen, 2006). Additionally, to our knowledge, little to no work has been conducted on the genetic heritability of depression across races. The singular twin epidemiological study looking at racial differences in the heritability of depression conducted by Duncan and colleagues (2014) found no differences between African American and European American women (Duncan, Munn-Chernoff, et al., 2014).

Gene by Environment and Candidate Gene Studies

Over the last couple of decades, molecular genetic analyses have become increasingly popular in developmental psychopathology. In fact, depression played a prominent role in the increased use of genetic markers when a paradigm-shifting study was published by Caspi and colleagues (2003). The prospective study reported that the interaction between stressful life events and the serotonin transporter gene (5-HTT) was related to the risk for developing depression. This finding emerged after many studies looking at 5-HTT had found no main effect genetic influences on the development of depression. In humans, the promoter region of 5-HTT contains either a short ("s") or long ("l") repeat allele. The short allele leads to less efficient transcription compared to the long allele. Participants in the study who are carriers of the short allele were more sensitive to stressful life experiences and were more likely to later develop depression (Caspi et al., 2003).

Subsequent studies attempting to replicate this result have painted an inconsistent picture regarding the joint effect of 5-HTT and stressful life events. These discrepant findings have triggered an ongoing debate about the methodological challenges facing gene by environment studies (e.g., Caspi, Hariri, Holmes, Uher, & Moffitt, 2010; Karg, Burmeister, Shedden, & Sen, 2011; Risch et al., 2009). Although 5-HTT has notably gotten the most attention in relation to depression, many additional candidate genes have been studied. There are varying amounts of support for genetic variations in APOR, DRD4, GNB3, HRT1A, MTHFR, and SLC6A3 as being related to increased risk for depression (Flint & Kendler, 2014).

Specific genetic effects become increasingly complicated when you include the role of developmental timing on the impact of environmental events, genetic expression, and depressive phenotypes. Additionally, there are potential interactions between genetic variants, downstream biological mechanisms, and improperly accounted for confounding variables such as ethnicity, gender, age, or socioeconomic status (Flint & Kendler, 2014; Keller, 2014). Over the last decade, there has been a corrosion of confidence in candidate gene by environment studies based on underpowered studies, unverifiable correction methods for multiple testing, and the difficulty in verifying unpublished work (Duncan & Keller, 2011). However, with more rigorous investigation and proper steps taken to rectify errors in methodology, the true value of gene by environment studies has yet to emerge. Not only may this clarify some of the most pressing concerns regarding genetic risk for depression, but also it may highlight the role of genes for a wide variety of psychological conditions.

Genome-Wide Association Studies (GWAS)

Genome-wide association studies (GWAS) have also become increasingly prominent in the field of psychopathology as a different methodology to study the role of genes in the development of disorders. GWAS utilize genome-wide sets of common genetic variants known as single nucleotide polymorphisms (SNPs) to differentiate which variations are associated with observable traits or behaviors. This method allows scientists to scan whole genomes to see if multiple genetic variants are related to the expression of a depressive disorder. Typically, a genetic variant has to be present in the population at frequency greater than 5% for the markers to detect the genetic signal. Detection is also related to the degree of localized correlation between neighboring markers. Consequently, if the theoretically causative variant is present in less than 5% of the population or not correlated with markers on the array, it cannot be detected.

Early genome-wide association studies of depression have produced largely underwhelming results. Despite having sample sizes similar to successful studies for other common diseases and phonotypes, no significant SNPs in early studies of depression emerged. The biggest lesson gained from early studies is that the effect of most SNPS on depression are small in magnitude. Therefore, a large sample is necessary to identify the genetic loci associated with depression. This trend of negative results continues for GWAS of specific depressive symptoms, in which studies have largely failed to find associated correlates with common symptoms of depression (Dunn et al., 2015). Only a handful of studies we are aware of have attempted to take a developmental approach by using GWAS to analyze which molecular genetic SNPs correlate with age of onset for MDD. These studies, too, have failed to find associated SNPs (Power et al., 2012; Ripke et al., 2013)

Further, many genes that have gathered nominal support via candidate gene studies (APOE, DRD4, GNB3, MTHFR, SLC6A3, SLC6A, and 100 others) have amassed no support from GWAS studies to date. Conversely, several candidate gene markers such as the serotonin transporter 5-HTTLPR variable tandem repeat is not captured by the typical GWAS platforms. Although some groups have developed techniques to derive estimates of these markers through available SNP data, the new techniques have not been widely

adopted and existing evidence is not particularly compelling (Dunn et al., 2015).

It is evident that the multiple issues with molecular genotyping of complex phenotypes, such as depression, have presented an enormous challenge to scientists. Depression is a polygenic disorder which arises from the combined effect of multiple genetic variants with individually small effect sizes. Depressions phenotypic expression is also often variable and has a fairly common lifetime prevalence of around 15% (Hasin, Goodwin, Stinson, & Grant, 2005). The common prevalence rate makes it challenging to differentiate disordered groups from the control group. Additionally, depression is a particularly heterogeneous disorder in which almost 1500 symptom combinations can fulfill the diagnostic criteria for MDD (Østergaard, Jensen, & Bech, 2011). Different subtypes of depression, such as early onset or recurrent episodes, may denote variations in risk. There may also be differences in heritability based on sex or ethnicity. These findings provide evidence that in order to find genetic loci associated with depression, we either need to reduce our heterogeneous definitions of depression and restrict confounding demographic variables, or scientists need to substantially increase study sample sizes (Dunn et al., 2015).

Recent genome-wide association studies that employed the above techniques have located some of the first genetic variants associated with depression. The China, Oxford, and Virginia Common Wealth University Experimental Research on Genetic Epidemiology (CONVERGE) utilized a sample of 5303 Chinese women with recurrent MDD to reduce the heterogeneity of the phenotype and 5, 337 controls. They found two loci contributing to risk for recurrent MDD on chromosome 10, one near the SIRT1 gene and another in the intron of the LHPP gene. A subsequent analysis of 4509 individuals with severe MDD yielded an increased genetic signal at the SIRT1 locus. The existence of this allele is relatively rare among individuals of European decent, suggesting possible differences in biological pathways for different ethnicities (Converge Consortium, 2015). By utilizing more homogeneous groups of people, we may be able to further differentiate various genetic pathways to developing depression.

Epigenetics

While GWAS has been an exciting invention to explore possible genetic correlates, it often fails to account for environmental influences on genetic expression. Conversely, epigenetic techniques exclusively focus on how DNA can be influenced by the environment. Epigenetics involve functional changes to the genome where certain genes may be turned off or turned on without changing the underlying nucleotide sequence. Examples include changes to DNA methylation and histone modification (Sun, Kennedy, & Nestler, 2013). The heterogeneous nature of depression and "missing heritability" between epidemiological studies and molecular studies make it an ideal candidate for epigenetic studies. Further, epidemiological studies suggest that exposure to stressful life events is related to increased risk for depression, albeit with huge individual variability in vulnerability (Dudley, Li, Kobor, Kippin, & Bredy, 2011; Hammen, 2005).

Animal models of depression have exacerbated this hypothesis by showing that forms of early life stress (e.g., maltreatment, maternal separation, low levels of maternal care) are related to alterations in DNA methylation and histone modification at promoters of genes such as brain-derived neurotrophic factor (BDNF) as well as changes in miRNA expression patterns. For example, a seminal study in rats showed that low levels of licking and grooming – a marker of maternal care – were associated with increased methylation of glucocorticoid receptors in the offspring. Increased methylation was related to attenuated stress responses (Weaver et al., 2004). Similar results have been found in human subjects where altered methylation patterns were found in genes implicated in depression (e.g., BDNF, glucocorticoid receptors, serotonin transporter, and ribosomal RNA promoter) after the experience of early life stress. These epigenetic alterations may even be passed down generations

(Dalton, Kolshus, & McLoughlin, 2014). However, all studies should be cautious in their interpretations of such data and in making sure they are adequately powered for these studies (e.g., Mansell et al., 2016). Much work regarding the implications of these pathways is yet to be done, but it represents an exciting emerging field in which environment, genetics, and developmental timing can all be taken into account. Epigenetic modification of gene expression may provide novel biomarkers to predict susceptibility to depression, improving diagnosis, and aiding in intervention.

Genetic and Epigenetic Effects on Interventions

In addition to the pathogenesis of depression, research on human and animal models suggest that epigenetic modulation of gene expression may be involved in the mechanism of treatment. Antidepressants have been found to cause changes in DNA methylation and chromatin activation of BDNF and miRNA expression. Additionally, electroconvulsive therapy (ECT; the most acutely effective treatment available for severe depression) has been shown to have similar epigenetic effects (Dalton et al., 2014).

Behavioral and psychological interventions are also interested in epigenetic effects on treatment. It is largely appreciated that interventions do not succeed for all participants, but our understanding of how individual factors influence intervention efficacy is still in its infancy. Most of this work is guided by differential susceptibility models which suggest that those most likely to be adversely affected by negative environmental experiences are also those most likely to benefit from contextual support. This theory implies that specific characteristics of people make it more likely that both positive and negative experiences will, respectively, affect the individuals positive and negative functioning and development (e.g., Belsky & Pluess, 2013). For example, those carrying one or more serotonin transporter-linked polymorphic region gene (5-HTTLPR) short alleles have shown both increased positive and negative outcomes dependent upon rearing environments. Although these genetic factors have been thought to inform risk, there is also experimental evidence to suggest those who carry the "risk allele" benefit more from interventions (e.g., Cicchetti, Toth, & Handley, 2015; Drury et al., 2012; Kegel, Bus, & van IJzendoorn, 2011). This suggests that in the future, we may be able to utilize genetic information to further streamline the most effective treatments for individuals suffering from depression or at risk for developing depression. However, not all interventions interested in differential susceptibility are focused on genetic or epigenetic markers for sensitivity to environment. Behavioral (e.g., temperament; Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2007) and physiological (e.g., vagal tone; Conradt, Measelle, & Ablow, 2013) markers are also often theorized to denote differences in sensitivity.

Science has made huge strides in our understanding of how genes function (or don't function) in relation to complex behavioral phenotypes such as depression. However, we still have a long way to go until we even begin to crack the genetic code to common psychopathologies. Research on human genetics and psychopathological phenotypes is becoming increasingly collaborative. Current work and theory suggests that we can expect to find hundreds to even thousands of genetic variants and gene by environment interactions which contribute to the depressive phenotype. This may even vary dependent on sex, ethnicity, developmental timing of disease onset, and/or specific sets of symptoms. Scientists aim to unveil a variety of biological pathways to generate a deeper understanding of the processes which underlie the development of psychiatric disorders. This understanding may then be utilized to improve prevention and treatment strategies (Duncan, Pollastri, & Smoller, 2014). Further, we suggest that genetic work should shift its focus on to specific symptoms of depression such as sleep disturbances, irritability, or hopelessness. It may also be important to take into account the developmental timing of environmental events and symptom onset when con-

sidering the impact of genetic and epigenetic factors. Although the "gene" that leads to depression does not exist, by further understanding pathways and genetic markers, we may be able to make leaps and bounds in prevention and intervention treatment.

Neurobiology of Depression

Stress Physiology

Research investigating the biological correlates of depression have found strong associations with stress physiology systems. Children who experience repeated or extreme stressors early in life are susceptible to emotional and mental health problems throughout childhood and adulthood. The basic experience of stress is a necessary aspect of everyday life. Stress systems are constantly engaging in allostasis, the regulation of vital functions in response to typical stressors. In fact, overcoming experiences of stress facilitates adaptation and resilience (Lyons & Parker, 2007). However, prolonged allostatic regulation, caused by chronic or extreme stressors, results in the wear and tear of critical stress-regulatory systems. This allostatic load reduces the efficiency of stress systems and results in long-term negative impacts. Changes in neuroendocrine and autonomic circuits affect vigilance to threat and responsiveness to stressors, among other processes. These processes contribute to the wide-ranging negative effects of chronic adversity. A CDC study of over 8000 adults reported a dose-response relationship between number of childhood adversities and experience of depression in the last year or across time (Chapman et al., 2004). Childhood stressors also increase the likelihood of a lifetime suicide attempt by a magnitude of two to five (Dube et al., 2001). Stressors experienced during childhood may have particularly lasting effects, as biological systems are in sensitive stages of development (Gunnar & Quevedo, 2007). Indeed, researchers have found instances of depression associated with childhood, but not adult, experiences of abuse (McCauley et al., 1997).

HPA Axis

When the body interprets physical or psychological threats in the environment, the stressor requires mobilization of a rapid response, such as the fight, flight, or freeze system in the face of an acute stressor, or a more sustained response in the face of a chronic or prolonged situation of stress. The faster system is primarily controlled by the sympathetic-adrenomedullary (SAM) system. The hypothalamic-pituitary-adrenal (HPA) axis is responsible for the slower, longer-term response. The HPA axis is the major neuroendocrine stress-mediating system. It is often measured by cortisol production, either in diurnal rhythms (typical daily fluctuations of production) or in response to acute stressors. Chronic stress can result in either hyper- or hypoactivation of the HPA axis, depending on the type and timing of the stressor (Gunnar, Doom, & Esposito, 2015). Depression is consistently associated with hyperactive HPA axis. Cortisol levels are found to be higher in depressed individuals in response to acute stress and remain at elevated levels for longer periods. Depression is also associated with a flatter diurnal rhythm, caused by an inability to downregulate cortisol levels at the appropriate time (Dienes, Hazel, & Hammen, 2013; Heim & Binder, 2012). Studies by Heim and colleagues found that women who experienced childhood abuse showed greater HPA reactivity, as well as greater autonomic reactivity, than healthy controls. Women with a history of abuse but no current or past depression showed increased activity of the adrenocortical hormone (ACTH), a product of earlier stages of the HPA axis. Increased ACTH activity also was found in those with current depression. However, non-depressed women did not have increased cortisol levels. This finding could indicate a factor of resilience in the adrenal adaptation to central sensitization (Heim, Newport, Mletzko, Miller, & Nemeroff, 2008). In a series of studies relating the HPA axis to depression, Heim and colleagues (2008) find evidence that childhood trauma is associated with changed HPA functioning and sensitization of stress responses, which are associated

with depression. Children and adolescents who are at risk for depression show similarly altered HPA function, and this changed functioning serves as a predictor for later development of depression (Chen, Joormann, Hallmayer, & Gotlib, 2009; Halligan, Herbert, Goodyer, & Murray, 2004).

Treatment studies can help to elucidate a causal relationship between increased HPA activity and depression. Medication trials in adults have shown that antidepressants cause reductions in corticotropin-releasing hormone (CRH), the hormone that induces the release of cortisol. Reductions occur in both depressed and non-depressed individuals, indicating that reduced CRH may be an effect of medication, not be an indication of improved symptoms (Wilkinson & Goodyer, 2011). A number of pharmacological intervention studies show a reduction in HPA axis caused by medication is associated with decreased depressive symptoms, suggesting that the HPA may have a causal role (Gunnar et al., 2015). This causal relationship has been more difficult to establish in children. Research examining the role of puberty on physiological effects of early adversity may provide some insight. Diurnal rhythms in individuals with a history of high early life stress differed according to pubertal stage, with blunted morning cortisol levels earlier in puberty and heightened levels later in puberty (King et al., 2017). In a recent paper, Gold (2015) proposes a framework of understanding depression through stress responsivity. He postulates that depression is a dysregulation of the stress response, in which multiple feedback loops within a normal stress response are hyperactive (Gold, 2015).

Neurobiological Correlates of Depression: Autonomic Nervous System

The SAM system activates the fight, flight, or freeze response to a stressor. The system releases epinephrine in the face of threat, which increases norepinephrine activity to increase heart rate, divert blood flow to crucial organs, and increase production of glucose. These responses are downregulated following the stressor by the parasympathetic nervous system. Activity in the autonomic nervous system (ANS) in general is also a strong indicator of emotional activity. The parasympathetic heart rate deceleration occurs through the vagus or the tenth cranial nerve.

Cardiac vagal tone is considered a marker of emotion regulation. Research has found that it indicates emotional expressiveness, temperament characteristics, aggression, and behavioral inhibition in children and infants, as well as psychopathological symptoms in adolescence and adulthood including depression (Beauchaine, 2001). Respiratory sinus arrhythmia (RSA) is a standard measure of vagal tone. Studying the development of RSA reactivity as it relates to emotion regulation, and the social processes associated with emotion regulation, can provide insight into the development of depression. Strong levels of RSA reflecting effective emotion regulation may serve as a protective factor against psychopathology. In a study specifically examining biological mechanisms of resilience for depression, Shannon and colleagues found that low levels of respiratory sinus arrhythmia (RSA) conferred risk for child depression, while high levels had some protective function, in children from low socioeconomic neighborhoods (Shannon, Beauchaine, Brenner, Neuhaus, & Gatzke-Kopp, 2007). Higher RSA reactivity in an emotion induction is also found in individuals with depression. RSA reactivity indicates greater emotional lability. RSA proves to be a useful developmental tool, as it marks adaptation to developmentally salient tasks at different points in life. It can mark developmentally appropriate emotion regulation at each age (Beauchaine, 2001).

Neuroimmunology

Recent research has identified changes in immune function associated with depression, sparking mounting interest in the role of neuroimmune function and inflammation in the ontogeny of depression. Patients with depression have been found to have increased levels of inflammatory

markers; particular emphasis has been placed on the cytokine interleukin-6 (IL-6; Dowlati et al., 2010). Depressed individuals also have a greater likelihood of developing inflammatory illnesses (Fenton & Stover, 2006). Inflammation has been proposed to work in concert with early adversities to increase risk for disease. Individuals who have experienced early life stress are not only at risk to develop depression but also a range of cardiac, immune, and other disorders (Danese & McEwen, 2012). Adolescents who were exposed to high childhood adversity and went on to develop depression exhibited accompanying increased levels of inflammatory biomarkers IL-6 and C-reactive protein (CRP; Miller & Cole, 2012). Adolescents without exposure to early adversity do not show the same effects, consistent with findings that only depressed adults who had been exposed to maltreatment showed elevated inflammation (Danese et al., 2008). In studying the particular effects of adverse parenting practices, a longitudinal study of African American youth also found a coupling between the development of depression and inflammation as a result of harsher parenting during childhood. Further, this study found that the relationship between harsh parenting and depression and inflammation is mediated by stress and the nature of romantic relationships during the child's young adulthood, suggesting that parenting practices impact inflammation and depression through their effects on the child's future relationship styles (Beach et al., 2017). Findings such as these indicate that early stressors pave the way for inflammatory pathways to disease (Miller & Cole, 2012).

Nusslock and Miller (2016) propose a neuroimmune network hypothesis to conceptualize the effect of early life stress on immune function. Just as childhood adversity sensitizes the HPA axis, it also sensitizes immune cells involved in inflammation. Many disadvantaged children are also more likely to be exposed to environmental factors that result in larger production of inflammatory cytokines. The hypothesis posits bidirectional pathways between stress and immune systems, and immune systems and reward circuitry. Communication in these pathways is increased in the case of early life stress. This may be particularly relevant to depression, which is characterized in part by reduced reward sensitivity. Inflammatory cytokines mediate reduced reward sensitivity in response to infection as well, and some studies have found inflammation to predate depression. Research is moving forward in promising directions to understanding whether and how immune systems can serve as a mechanism for psychopathology (for a review, see Nusslock & Miller, 2016; see also Hodes, Kana, Menard, Merad, & Russo, 2015).

Neuroanatomy and Circuitry

In recent years, the increasing availability of methods to investigate brain mechanisms has provided the opportunity to examine the neural correlates of depressive psychopathology and its risk factors. Both the DSM-5 and the RDoC framework have called for basic neuroscientific research to identify biomarkers of clinical disorders (Charney et al., 2002). Identification of neural signatures of disorders will accelerate accurate diagnosis and contribute to effective treatment. Electroencephalography (EEG) and functional magnetic resonance imaging (fMRI) provide insight to general and specific neuroanatomical regions and neural circuits that play a role in depression. Depression is associated with the emotion-related process of reward valuation. In the reward and motivation literature, systems of approach support goal-directed behavior and positive affect, while systems of avoidance support negative affect and negative stimulus response (Davidson, 1998). Depression is characterized not just by a deficit in positive affect but also by approach-related motivation (e.g., Davidson, 1992). The study of the development of depression has been more limited than research about adult depression, but an expanding literature reveals some consistent patterns. Because the neuroimaging of developmental psychopathology is in a relatively nascent stage, much more work needs to be done to fully understand how the study of the brain can contribute to our knowledge base.

Early research on the neural correlates of depression centered around EEG findings. Mental

disturbances relating to emotion have been associated with hemispheric asymmetries. Evidence shows that the frontal cortex is lateralized for negative and positive affect, with left-frontally activated individuals showing less negative affect and greater positive affect than right-frontally activated individuals (Tomarken, Davidson, Wheeler, & Doss, 1992). In a similar vein, a number of studies have attempted to correlate depressive symptoms with frontal asymmetry. Findings have been mixed, with some studies showing differences between depressed and control groups and some with null results. However, a meta-analysis of this work determines that there is a moderately strong relationship between depression and relative right hemispheric activation (Thibodeau, Jorgensen, & Kim, 2006). From a developmental perspective, infants of depressed mothers are also confirmed to have relative right-sided EEG asymmetry. A somewhat large literature examines frontal asymmetry in the emotion-related processing of normative adults, depressed adults, and their infant offspring (see Coan & Allen, 2003, for review). However, there is much space for growth in examining asymmetries during childhood and adolescence. Given the relative ease of EEG methodology in younger participants, this research should be carried out to provide insight into the development and heritability of depression.

EEG has proven to be a useful tool in both resting state analyses and task-based function. Event-related potentials (ERPs) allow us to examine specific components as the brain is engaged in a task. ERPs have been used to identify variations in reward sensitivity within depressed individuals. Previously described EEG research shows that depressed individuals are less likely to show an asymmetry reflective of approach (Shankman, Klein, Tenke, & Bruder, 2007). ERP studies have found a component that is greater in response to negative outcomes (such as monetary losses). This component, the feedback negativity (FN), most likely originates from dopaminergic disinhibition in the anterior cingulate cortex (Holroyd & Coles, 2002). Research using the FN in depressed individuals shows that depressive symptoms are associated with reduced sensitivity to negative outcomes in relation to rewards, reinforcing the idea that depression is associated with a reduced approach system and decreased reward sensitivity (Foti & Hajcak, 2009). In a study of children and adolescents, the FN uniquely predicted depression over anxiety (Bress, Meyer, & Hajcak, 2013). As is the case with resting state EEG, research associating ERPs with depression during development is currently limited.

A much larger recent literature has bloomed using imaging technology to determine the neural correlates of depression development. Research in the field of developmental affective neuroscience has focused on the amygdala and prefrontal cortex (PFC), areas critical for emotion processing and regulation. The amygdala is critical for detecting emotional salience of environmental stimuli and for developing conditioned fear responses. It is repeatedly shown to activate in response to emotional stimuli. The PFC tonically inhibits the amygdala, restraining emotional reactivity. It is critical for executive functioning abilities, including cognitive control and behavioral inhibition. The hippocampus and anterior cingulate, and connected areas, are also implicated.

Phillips, Ladouceur, and Drevets (2008) present a neural model of emotion regulation to use in the context of mood disorders which subdivides automatic and voluntary regulation. Their original model identified the distinction between a ventral system, which includes the amygdala, insula, ventral striatum, and ventral regions of the anterior cingulate gyrus and PFC, and the dorsal system, which includes the hippocampus and dorsal regions of the anterior cingulate gyrus and PFC. In this model, the ventral system is responsible for the identification of emotionally salient stimuli, while the dorsal system facilitates cognitive processes of executive function and voluntary control (Phillips, Drevets, Rauch, & Lane, 2003). A model developed by Ochsner and Gross (2007) identifies a bottom-up system, including the amygdala and basal ganglia, and a top-down appraisal system, including the dorsomedial, dorsolateral, and ventral prefrontal cortices. They characterize the study of development of emotion

regulation as an assessment of the strength of the top-down system to control bottom-up impulses (Ochsner & Gross, 2007). The most recent neural model integrates both, subdividing emotion regulation as a function of the regulation strategy as behavioral, attentional, or cognitive, and whether the strategy was automatic or voluntary (Phillips et al., 2008).

Attempts to consolidate research about the neuroscience of MDD during adulthood (Rive et al., 2013) and development (Kerestes, Davey, Stephanou, Whittle, & Harrison, 2014; Miller, Hamilton, Sacchet, & Gotlib, 2015) reveal interesting differences between the two. Consistent with the above model, youth MDD is found to involve variations in both the top-down and bottom-up processes of emotion. In particular, abnormalities are identified in ventromedial frontal regions, the anterior cingulate, and the amygdala (Kerestes et al., 2014). Notably, adolescents appear to be more vulnerable to depression, with onset of affective disorders particularly high and generally heightened emotionality (Guyer, Silk, & Nelson, 2016). Some have proposed that this can be partially explained by differently timed maturation of neural systems associated with emotion generation and reward processing, such as the amygdala and nucleus accumbens, and emotional control, such as the PFC (e.g., Casey, Jones, & Somerville, 2011). Findings of altered activation and connectivity in children with MDD parallel that of adolescents with MDD, but relatively few studies and small sample sizes identify a need for further research (Kerestes et al., 2014).

Family Processes and Attachment Relationships

Although biological markers are critical in understanding depression, they interact closely with a child's experience. Early social contexts must be explored to fully understand an individual's emotional development. In particular, the development of depression has been closely linked with parenting. Caregivers serve as a unique figure in a child's life and form the strongest bonds the child will have for many years. Although children may interact with many different individuals, the ways in which they seek out and rely upon caregivers, and communicate needs and emotions, aren't found in any other interaction. Caregivers facilitate every meaningful aspect of a child's life: they provide security and support during exploration; they provide guidance in the development of cognitive abilities; they enable stimulating play and social experiences; and they transfer their morals, values, and emotional styles. Such a wide influence on a child's life prompts researchers to turn first to caregivers as explanatory factors. Early experiences with caregivers play a large role in the development of socioemotional functioning and can predict risk for internalizing symptoms. During the first year of life, the attachment relationship infants form with their caregiver has lasting implications for social adjustment and mental health. Socialization of values regarding emotions and emotion regulation throughout childhood impact a child's cognitive, affective, and biological systems. Further, the synchrony between a parent and child's mental functioning implies a transfer of genetic and biological vulnerability or strength. In this section, we discuss the impact of attachment relationships, family histories of psychopathology, and the socialization of emotion regulation in the home.

Attachment Relationships

Bowlby's (1969) attachment theory suggests that the bond that infants form with a caregiver is a foundation for personality and socioemotional development (Bowlby, 1969). This theory, and the subsequent characterization of parent-child relationships, has served as a primary framework with which to view variations in socioemotional adjustment through life. It has provided insight into trajectories of mental health and had a major impact on the field of developmental psychopathology (Fearon, Groh, Van Ijzendoorn, Bakermans-kranenburg, & Roisman, 2016). Bowlby found that infants rely on attachment figures to provide a secure base from which they can

investigate the environment. By providing security, the caregiver regulates the infant's affective state as (s)he explores novel parts of the environment.

Continuing research, notably from Ainsworth, Blehar, Waters, and Wall (1978), characterized the type and quality of relationship between caregiver and child based on features of responsivity and sensitivity and suggested that this relationship results in individual differences in developing cognitive and affective styles. A securely attached infant uses the caregiver as a secure base as they branch out and explore novel objects and people. Inconsistency or unresponsive care leads to insecure attachments. Three types of insecure attachment relationships have been identified: ambivalent, avoidant, and disorganized (Ainsworth et al., 1978; Main & Solomon, 1986).

Attachment styles are characterized through observation of the infant's behavioral response to separation from and reunion with the caregiver. Infants with ambivalent, or resistant, attachment behaviors stay in close proximity to the attachment figure, a dependence that seems to aim for attention from an inattentive or inconsistent caregiver. These infants are distressed by separation from the caregiver but also aren't soothed by the caregiver's return. Infants with avoidant attachment behaviors show decreased dependence on caregivers, ignoring or avoiding them. Caregivers in these relationships typically reject or neglect the child consistently, such that avoidant attachment behaviors protect a child from further rejection. These children have often learned that negative affect expression is inappropriate. Infants with disorganized attachment relationships appear to consider caregivers as a source of both security and stress, resulting in behaviors that are incoherent and contradictory. These infants often have caregivers who are unavailable, distant, or antagonistic.

The development of internalizing symptoms during childhood has been associated with attachment theory. Bowlby posited that depression vulnerability is conferred from uncontrollable and prolonged unavailability or loss of caregiver. Beyond infancy, attachment relationships continue to have consequences on psychological functioning through the development of working models or internal representations of the self, the caregiver, and experiences with the caregiver (Bowlby, 1969, 1980). Insecure relationships can establish a working model of the self as unworthy, a characteristic feature of depressive symptomatology. These working models influence future interpersonal relations and a persisting negative view of the self. A secure relationship is more likely to foster confidence and self-worth, buffering against psychopathology.

A child's working models of the relationship are considered to be a building block of emotion regulation capacity. Insecure attachments create an expectation that there will be incomplete or inconsistent responding to emotional signals, resulting in the development of less adaptive emotion regulation strategies (Cassidy, 1994). Because emotion regulation is strongly implicated in the development and process of internalizing disorders, this is one mechanism by which attachment styles can confer risk for or protect against the development of depression. Secure attachment relationships facilitate open and direct communication of emotions, based on the expectation that emotions will be responded to. Given the expectation of rejection, infants with an avoidant attachment relationship are found to minimize or suppress their emotions, a behavior that can facilitate continued closeness with a caregiver and avoids risk for further rejection (Cassidy, 1994). However, studies have found that the tendency to suppress extends into childhood and into other social contexts (Lutkenhaus, Grossmann, & Grossmann, 1985). Ambivalent infants, conversely, are more likely to heighten their emotional expression, in order to draw attention from the caregiver, thereby increasing their emotionality (Cassidy, 1994).

Attempts to draw explicit empirical links between attachment types and psychopathology have been expansive, revealing mixed results. In a meta-analysis of 42 independent samples, there is an association between early attachment variation and internalizing symptomatology in childhood. The association is small (d = 0.15) and weaker than the association between attachment variation and externalizing symptoms (Groh,

Roisman, van Ijzendoorn, Bakermans-Kranenburg, & Fearon, 2012). A similar meta-analysis of 60 studies found a small but significant effect size ($d = 0.19$ after adjustment for publication bias; Madigan, Atkinson, Laurin, & Benoit, 2013). However, a review of literature relating attachment and internalizing pathology reported that the relationship does seem to exist (Brumariu & Kerns, 2010). When assessing whether attachment insecurity type relates to specific symptomatology, few studies provide conclusive results. Avoidant attachment has been found to have weak associations with internalizing psychopathology, while resistant and disorganized attachment are not (Groh et al., 2012; Madigan et al., 2013). These findings are inconsistent with theories that resistant attachment should confer risk for internalizing symptoms (see Fearon et al., 2016 for review).

In line with Bowlby's conceptualization of attachment as one key experience of many, it's important to consider mediating and moderating factors that render attachment security as a protective or risk factor for pathology, rather than defining. In their meta-analysis, Groh and colleagues found that age is not a moderator for the relationship between attachment security and internalizing symptoms, indicating that the effect of attachment styles persists into adolescence. This may be due to a continuing influence of the parent-child relationship. It could also be a result of the early effects that attachment relationships have on internal working models of the self, shaping experiences and relationships of the individual beyond infancy. They did not find socioeconomic stress to be a significant moderator, opposing the idea that attachment insecurity effects are greater in populations with additional economic stress. Madigan and colleagues found a number of significant moderators of the relationship between attachment variation and internalizing symptomatology, including concurrent externalizing behavior and gender, among others. Some studies suggest that gender and socioeconomic status play a combined role in the effect of insecure attachment style on development of psychopathology (Belsky & Fearon, 2002; Fearon & Belsky, 2011).

Parental Depression

Key in the study of child outcomes is the study of parents themselves. An estimated 15 million children live in a household with a parent with major or severe depression in the United States (England & Sim, 2009). Depression within the family, particularly maternal depression, is strongly associated with psychopathology and behavioral maladjustment (Cummings & Davies, 1994). The risk of developing a first episode of MDD increases threefold in children and adolescents with a first- or second-degree relative with the disorder (Williamson et al., 1995).

A meta-analysis of the large literature on maternal depression confirms that the association with internalizing in children from infancy to young adulthood is significant. However, the analysis reports a small effect size and shows that the association is no greater than that between maternal depression and externalizing (Goodman et al., 2011). Unsurprisingly, the association between parental and child internalizing plays out through a number of pathways which add nuance and heterogeneity to child outcomes. Although psychopathology in a caregiver has long been expected to result in the disruption of a child's mental health, mechanisms of this relationship are still becoming clear. We highlight the following mechanisms through which maternal depression is conferred to children: attachment relationships, co-occurring stressors, timing and course of maternal depressive episodes, demographic characteristics of the child, synchrony of neural patterns, synchrony of stress physiology, and emotional regulation. Each of these domains interacts with each other, with certain domains triggering maladaptation in other domains throughout the lifespan.

Attachment relationships with depressed mothers are more likely to be insecure, regardless of other risk factors (Cicchetti, Rogosch, & Toth, 1998). Bowlby (1980) originally suggested that unavailability from caregivers struggling with depression can elicit a sense of loss mirroring the actual loss of a caregiver, resulting in attachment insecurity (Bowlby, 1980). This assertion has since been corroborated by a number of studies finding evidence of greater likelihood of insecure

attachment in relationships with a depressed mother. In studies that don't find this association, variability can be explained by duration and severity of the depression (Cicchetti et al., 1998).

Depression is inherently shaped by an individual's social environment (Downey & Coyne, 1990). Depressed parents are often facing co-occurring problems, like socioeconomic stressors, marital or relational conflict, or insufficient social support. Families with a depressed parent are shown to experience more contextual risk, including greater perceived stress, parenting hassles, and family conflict, and lower perceived social support and marital satisfaction (Cicchetti et al., 1998). They additionally report more stress with jobs and finances and have children who report a higher rate of chronic stress (Hammen, 1991). Daughters of depressed mothers report higher exposure to more severe chronic stressors than daughters of healthy mothers. Moreover, among well daughters of depressed mothers, those who went on to develop psychopathology reported higher exposure to stress than those who remained free of symptoms (Gershon et al., 2011). These kinds of environmental stressors are likely independent direct causes of child maladaptation. Severity and frequency in each of these domains may also create variable consequences, resulting in the heterogeneity we see in offspring of depressed mothers. Further, depression itself can instigate marital conflict or an increased burden on the non-depressed parent, resulting in further stress on the child. Depressed women are shown not only to have a higher rate of marital conflict but also a tendency to marry others with psychological disturbances, allowing both individuals to contribute to the other's symptom severity and parenting struggles (Downey & Coyne, 1990). Given the high prevalence of marital discord in marriages with a depressed individual, relationship conflict has been argued to be a strong mediator for the relationship between maternal and child depression (Gotlib & Avison, 1993). It should be noted that although co-occurring risk factors play an important role, they do not tell the whole story. For example, in one study, contextual risk did not contribute to the relationship between maternal depression and insecure attachment in toddlers, signifying that depression is adversely affecting the child in other ways (Cicchetti et al., 1998).

Sensitive periods of development denote a period in which an individual develops specific skills rapidly during a certain window of time, after which change in those skills is difficult and slow. Given this concept, much literature has assumed that earlier exposure to maternal depression will result in more severe outcomes, as earlier effects on a child would result in greater cascading effects (Goodman & Gotlib, 1999). Therefore, the timing of onset of depression in a mother would be of great interest. Indeed, many children experiencing a depressive episode do so in close temporal proximity to an episode of depression in their mother (Hammen, Burge, & Adrian, 1991). Meta-analytic review provides backing for these claims, finding age to be a moderator for associations between maternal depression and child internalizing psychopathology. A proposed mechanism suggests that younger children are more vulnerable to mothers' pathology, while older children have a stronger basis of healthy development, less dependence on their mother, and a greater cognitive understanding of their mothers' symptoms (Goodman et al., 2011). However, these results are presented as tentative given study constraints. In a more recent community sample of over 800 mothers of children under 10 years of age, Hammen and Brennan (2003) found that children had elevated risk for depression after any exposure to maternal depression. The timing of the depressive episodes and severity of depression did not differentially predict risk. However, early-occurring episodes of depression are often associated with chronic depression and/or dysthymia, and it is difficult to tease apart the effects of timing and chronicity. Given that depressed adults are likely to experience multiple depressive episodes, likewise, few children experience only one episode of maternal depression. Research has yet to clarify the interaction between a child's age at the first episode and the number of episodes through childhood. Mixed results call for further study of how exactly

developmental timing plays a role in a child's mental health trajectory.

The risk for MDD onset is greater when there is a family history of the disorder beyond just parents (Williamson, Birmaher, Axelson, Ryan, & Dahl, 2004). These findings suggest the possibility that earlier-onset depression is more a consequence of genetic than environmental risk. The intergenerational risk for depression has also consistently been found to be stronger in girls than boys (Goodman et al., 2011; Goodman & Gotlib, 1999). Some have suggested that women are at a greater genetic risk for developing depression (Kendler et al., 2001). Gender constructs resulting in different parenting attitudes toward girls may play a role. Maternal depression may also affect boys differently, resulting in other forms of psychopathology. Finally, other anxiety disorders in the mother have been shown to predict childhood onset of depression beyond a family history of depression (Williamson et al., 2004). Therefore, examining the effects of other disorders of affect in mothers on the development of internalizing will also be of key interest in understanding trajectories of depression.

One possible mechanism of the transference of psychopathology across generations besides genetic vulnerability is the synchrony in biological systems of mothers and children. Cortisol levels are found to have concordance between mothers and adolescents (Papp, Pendry, & Adam, 2009). A study of diurnal cortisol production in mothers with a history of depression and their children found that cortisol production in mothers and daughters were coupled. Depressed pairs consistently showed higher cortisol production (LeMoult, Chen, Foland-Ross, Burley, & Gotlib, 2015). Evidence also supports concordance of neural systems involved in emotional processing and depression. Research shows that depressed mothers and their daughters have concordant anomalies in cortical thickness (Foland-Ross, Behzadian, LeMoult, & Gotlib, 2016) and task-based brain activation (Colich et al., 2017; for a review see Ho, Sanders, Gotlib, & Hoeft, 2016).

Emotion Socialization and Co-regulation in the Family

Although depressed mothers may confer vulnerable biological systems to their children, family socialization of emotions with or without a history of psychopathology is crucial in shaping a child's affective functioning. Starting from infancy, experiences building expectations for positive emotion regulation affect a cascade of developing regulatory abilities. Before children have the capacity to regulate their own emotions, their parents serve as regulators. Parents soothe the child during times of distress, distract the child from stressors, engage in activities to evoke positive emotion, and organize the child's day in a way that controls predictability and exposure to social experiences (Thompson, 2013). By responding appropriately and structuring an infant's world to reduce physiological tension, caregivers help to support the development an infant's own internal regulation.

The emotional content of parental interaction is also consequential in an infant's affective patterns. Seminal work in face-to-face mother-infant interactions found that infants respond to specific affective qualities for maternal behavior, such that positive affect is matched. Maternal disengagement is associated with greatest infant distress, and maternal intrusiveness is associated with infants looking away. One hypothesis suggests that infants with disengaged mothers receive inadequate regulatory support for their negative affect (Cohn & Tronick, 1989). In order to express their needs, infants need to effectively communicate nonverbally with their caregivers. As such, deviations in infant expression can result in lesser ability to elicit parental responsiveness. Populations with atypical expressiveness, such as those with Down's syndrome or congenital blindness, demonstrate the need for parents to adopt compensatory mechanisms for initiation and maintenance of communication. Similarly, maltreated populations demonstrate the effects of a parent's emotional style on an infant's own emotional control (Cicchetti & Schneider-Rosen, 1984a).

The capacity to regulate behavior and emotion continues to develop through childhood and adolescent years with familial and social input. Childhood emotion regulation and social competence are affected by parents' own emotionality, as well as by their reactions to a child's emotion (Eisenberg, Cumberland, & Spinrad, 1998; Shipman & Zeman, 2001). Researchers studying familial influence on emotion regulation suggest a tripartite model, in which a child learns through observational learning and modeling by family members, parenting practices explicitly related to emotions, and the general emotional climate of the family (Morris, Silk, Steinberg, Myers, & Robinson, 2007). Mothers' expressions of positive and negative emotions in the home influence children's emotional competence, a relationship which is mediated by the child's own self-regulation abilities (Eisenberg et al., 2001, 2003; Valiente, Fabes, Eisenberg, & Spinrad, 2004). Caregiver emotional responses present a model to children regarding how emotions should be valued and addressed. The values that parents assign to emotions, which can present themselves through acknowledgment and acceptance of their own emotions and their children's, and their attempts to support the child, result in differing emotional profiles of children as well (Gottman, Katz, & Hooven, 1997). Mothers with greater attention toward their own feelings and constructive emotion regulation strategies for a child are more likely to have children who deal adaptively with their emotions through problem-solving strategies (Thompson, Virmani, Waters, Meyer, & Raikes, 2013). Finally, parents' explicit responses to child emotion can leave negative effects when they are dismissive, punitive, and critical of the experienced emotion. These unhelpful types of interpersonal regulation may worsen the existing emotions, incorporate new negative emotions, and create obstacles for reaching or discovering effective regulatory strategies. Further, critical responses from a parent can ultimately become ingrained into the child's own emotional clarity and ability to problem-solve (Denham, Bassett, & Wyatt, 2007; Thompson, 2013).

Parents' explicit and implicit lessons in strategies for emotion regulation set the stage for socioemotional development. Depression is characterized by negative affect and a lack of positive affect. Evidence arises from findings that depressed adolescents use fewer and less effective emotion regulation strategies (Garber, Braafladt, & Weiss, 1995; Garber, Braafladt, & Zeman, 1991). Research regarding the direct associations between parenting and depression shows that adolescent depression is associated with parenting styles involving less warmth, more interparental conflict, overinvolvement, aversiveness, less autonomy granting, and monitoring (Yap, Pilkington, Ryan, & Jorm, 2014). Additionally, parents who have greater behaviorally observed expressed aggression, lower expressed positivity, or a greater tendency to respond to their children's emotions negatively are more likely to have adolescents at risk for depression (Schwartz et al., 2017). Findings like these indicate that parenting styles can impact children's risk and resilience for developing affective psychopathology.

Culture

Cultural Values Surrounding Emotions

Family values regarding emotional experiences are often closely linked with culture and lived experience. Despite its global use, the DSM diagnostic criteria for depression do not explicitly include cultural factors. Culture can be defined as the system of beliefs and values, and patterns of behavior, transmitted by a community to which one belongs (e.g., Kitayama & Uskul, 2011; Kroeber & Kluckhohn, 1952). These cultural factors are both absorbed by an individual and reinforced to others (Kashima, 2000). Cultural variations in what is considered normative result in varying ideas of typical and atypical trajectories. Therefore, understanding development and psychopathology must take into account differing standards of normative behavior. Culture

influences every aspect of a child's developing life (Causadias, 2013). Due to varying norms, we also need to consider how depression is typically experienced within a culture. Integrating culture into our concept of risk, protective, and promotive factors will further our understanding of the risk conferred by prejudice (e.g., Garcia Coll et al., 1996), and the promotive factors enmeshed in certain cultural practices (such as the emphasis on community in many Latino cultures; Causadias, 2013; Fuller & García Coll, 2010). Values or beliefs about emotion may result in the emphasis of symptoms other than sadness or emptiness, or a normative expression of grief that would be considered abnormal in Western cultures. A cultural norm hypothesis posits that depression is characterized by emotional reactivity that diverges from the culturally typical style of emotional expression and experience (Chentsova-Dutton et al., 2007). Experiencing symptoms of depression can further decrease one's ability to follow cultural norms, leading to further isolation and distress and exacerbating the symptoms (Chentsova-Dutton, Tsai, & Gotlib, 2010).

Affect valuation theory serves as a framework to understand the differences among cultures in emotion valuation (Tsai, 2007). The theory proposes that every individual has an "ideal affect," an emotional state that is most desirable. In research comparing East Asian and Western cultures, some similarities appear in ideal affect: across cultures, research shows that individuals want to feel more positive and less negative affect than they do. However, significant differences also emerge. East Asian cultures appear to value a balance of negative and positive emotions, while Western cultures appear to value greater positive emotions only (Tsai & Clobert, in press). In a study comparing the United States to Japan, researchers found that greater negative affect actually resulted in poorer psychological health outcomes in the United States than in Japan (Curhan et al., 2014). It may be that the greater value placed on negative emotions in certain cultures makes them less of an obstacle in mental health, particularly disorders of affect.

Alongside emotional valence, cultures vary in their valuation of emotional arousal. In European Americans, the discrepancy between actual affect and ideal affect with regard to high arousal positive emotions predicted depressive symptoms. Meanwhile, in Hong Kong Chinese, the same discrepancy with regard to low arousal positive emotions predicted depressive symptoms. Chinese Americans, who are exposed to both cultures, are affected by both types of discrepancies in positive emotion (Chentsova-Dutton et al., 2007). In concordance with the cultural norm hypothesis, depression indicated a departure from the cultural ideal of emotional arousal in both cases. Given that affective research often engages sad or otherwise emotional stimuli, these findings suggest that including culture in studies of psychopathology will provide a clearer picture of emotional response. Culture strongly impacts values surrounding both emotions and emotion regulation. For example, suppression, which has often been considered a maladaptive emotion regulation strategy, does not result in problems for Asian women (Butler, Lee, & Gross, 2007).

The concept of depression varies along cultural dimension as well. European Americans describe depression as a lack of high arousal positive emotion, while Hong Kong Chinese describe depression as the lack of low arousal positive emotion (Tsai & Clobert, in press).

Within the United States, perceptions of depression vary by culture as well. Rates of mental health treatment are lower among black, Hispanic, and Asian youth than non-Hispanic white youth. For those who do receive treatment, diagnosis and treatment offered by clinicians varies between races as well. Individuals receiving treatment themselves vary in how they perceive their symptoms. Racial and ethnic minorities are more likely to endorse externalizing or interpersonal problems, such as problems with rules, school, or others, than white individuals who had the same profile of depressive symptoms (Cummings, Case, Ji, Chae, & Druss, 2014). These effects could be a result of cultural variations in the perception of depression stemming from family or community values. It could also reflect the perception of others, concurrent with research finding that black and Hispanic youth are more likely

to seek treatment as a result of referrals (Takeuchi, Bui, & Kim, 1993). Understanding perceptions of mental health within various cultural communities is necessarily to properly serve them, as is appropriately training clinicians in implicit biases.

Social Influences Outside the Home

As children reach the preschool years, socialization of their emotional process extends to individuals outside the family. Social circles begin to incorporate friends, classmates, and teachers. This leaves space for the child to gain social support, which can buffer the negative effects of social and environmental stressors. At the same time, it exposes the child to the possibility of bullying or perceiving insufficient social support, making them more vulnerable to depressive symptoms. These experiences continue to influence an individual's emotional health through adolescence and adulthood. Research in stress physiology demonstrates changing socioemotional development in response to peer environments, especially in light of the robust positive associations between cortisol levels and depression. Research has shown that cortisol levels increase in 3- to 4-year-olds during full-day childcare, even when normal levels are experienced at home. In particular, cortisol levels were higher in younger children, shy males, and children with poor self-control and aggression (Dettling, Gunnar, & Donzella, 1999). Although the mechanisms for this rise are unclear, it could be that children are reacting to increased social pressures. It appears that those with traits associated with less adaptive caregiving styles are at greater risk for elevated cortisol activity. The increasing cortisol activity may also be associated with stressful experiences of certain children within the sample. Children who experience peer rejection have higher levels of cortisol within the classroom than those who do not, suggesting that these stressful experiences can shape the responsivity of biological systems from a young age (Gunnar, Sebanc, Donzella, & Van Dulmen, 2003). Greater HPA reactivity in these studies is specific to a full-day social context. Caregiving during this age remains the primary mechanism of the social buffering of stressors, emphasizing the importance of parents to buffer the possible negative outcomes that could arise from school stressors.

Bullying and Peer Victimization

As children progress through school years, the prevalence of bullying behaviors increases. In recent years, bullying is receiving increasing global mainstream media attention as a problem for school-aged children, associated with negative outcomes including depression. In part, this exposure is due to the ability for suicidal teens to publicly express the reasoning behind their actions through videos and messages on the internet. Many of these public cases have exposed bullying as the cause of suicide. Research dating back to the 1970s has examined the outcomes of bullying, describing it as repeated negative actions toward another individual, particularly when there is an unbalanced power relationship (e.g., Olweus, 1997). Victims are found to most often be characterized as anxious, insecure, and having low self-esteem. They also tend not to have close friendships. Although it is likely that bullying experiences enhance these traits, there is evidence that victims of bullying display the traits from a very young age (Olweus, 1997). These descriptions are reminiscent of existing associations with depression, including insecure attachment relationships that result in negative self-representations. Research has found that being the victim of bullying during primary school is associated with depression, placing individuals at risk of remaining in a cycle of bullying throughout childhood and even beyond. Furthermore, depressive symptoms are found in individuals with a tendency to bully others, which may be caused by issues in the family and home (Slee, 1995).

The effects of bullying are likely to last far beyond the experience of bullying itself. Bullying during childhood is shown to predict negative mental health outcomes through adolescence (Arseneault, Bowes, & Shakoor, 2010). Even

more alarming, individuals who reported bullying during childhood reported poorer outcomes four decades later (Takizawa, Maughan, & Arseneault, 2014). Higher levels of depression associated with bullying relationships are found, in the aggressor or the victim, in primary school (Slee, 1995), middle school (Seals & Young, 2003), and high school (Rigby, 2000; see Gunn III & Goldstein, 2017 for a review). Although the types of victimization may vary with age (e.g., Craig, 1998), the issue remains prominent throughout each age group. Adolescence is considered a time of particular emotionality and turbulence (Arnett, 1999). There is also a shifting of social landscapes during this time, as adolescents are spending less time with family and more with peers, expectations in peer interactions change, and romantic relations begin to arise (Nelson, Leibenluft, McClure, & Pine, 2005). Social relationships have greater importance to adolescents than children, making them more salient and more likely to have an impact on mental health (Brown & Larson, 2009). Due to this social reorganization, peer victimization is of special interest during adolescence. Frequent adolescent peer victimization is associated with higher levels of suicidal ideation and attempts compared to non-victimized peers. More types of victimization lead to even greater risk (Klomek, Marrocco, Kleinman, Schonfeld, & Gould, 2008; Rigby & Slee, 1999).

Risk and Protective Factors for Peer Victimization

Some mechanisms have been suggested as playing a role in exacerbating or protecting against the negative effects of peer victimization. For example, socioeconomic status and gender can put one at an increased risk for negative outcomes caused by difficulties in peer relations. The relationship between bullying and depressive symptomatology is stronger in children from a lower socioeconomic background than those with a higher socioeconomic status (Due, Damsgaard, Lund, & Holstein, 2009). It is also stronger in females than in males (e.g., Bond, Carlin, Thomas, Rubin, & Patton, 2001). This may in part be due to the different perception of peer victimization across genders. For example, Crick has repeatedly found disparities in relational aggression between males and females, reporting that girls consider relational aggression to be more hostile and hurtful to social relationships (Crick, 1995).

Adaptive forms of emotion regulation, both independent and interpersonal, can serve as protective factors for negative social experiences. Certain emotion regulation strategies will exacerbate the effects. Rumination, or the repetitive self-focused thinking and worrying about a situation, will most likely serve to extend the negative experience and internalize negative messages. McLaughlin and others found that both rumination and poor emotional understanding mediated a relationship between victimization and internalizing (McLaughlin, Hatzenbuehler, & Hilt, 2009).

Social Support

Perceived social support provides particularly strong regulation of negative emotions in social contexts. Borowsky and colleagues found that parent connectedness and perceived caring by friends and other adults mitigated the relationship between involvement in bullying and suicidal ideation or attempts (Borowsky, Taliaferro, & McMorris, 2013). Finally, strong peer relations are crucial protective factors in the face of other stressors outside of the school and peer group context (e.g., Jackson & Warren, 2000). Social support has been shown to downregulate HPA axis reactivity in the face of stressors and protect individuals from poor psychological and physical health outcomes. At the same time, those who have experienced early life stress are less able to draw buffering effects from positive social relationships (Hostinar & Gunnar, 2013). In a meta-analysis of perceived social support and depression in children and adolescents, support was found for the general benefits of perceived social support, as well as for the obstacles posed by greater early life stress. Interestingly, general

benefits from family members and general peer group were stronger than those from close friends, suggesting the importance of a broader network of social reward. Effects were stronger in depressed children and younger adolescents than in older adolescents (Rueger, Malecki, Pyun, Aycock, & Coyle, 2016). This is consistent with stress buffering work that finds parents are less able to buffer stress in their adolescent children than their younger children and that close peers do not take over this buffering role (Doom, Doyle, & Gunnar, 2016; Hostinar, Johnson, & Gunnar, 2014). The meta-analysis does find benefits from parents, so more work is needed in understanding the role of family during adolescence.

Stressful Life Experiences

Stressful life events play a substantial role in the development of depression across the life course and are one of the leading precipitating factors for the onset of a depressive episodes. Environmental stressors can include things like childhood poverty, child maltreatment, natural disasters, and death of a loved one, to name a few. Experiencing stressors typically precedes the initial elevation of symptoms and increases the likelihood of episode recurrence. In fact, the experience of a life stressor was 2.5 times more likely among depressed cases compared to controls, and 80% of depressed cases were preceded by stressful major life events (Hammen, 2005).

However, work over the last few decades has shed light on the bidirectional relationship between stress and depression by highlighting that depressed individuals are more likely to experience stressful events. The pessimism, irritability, low energy, and anhedonia typically associated with depression may contribute to eliciting negative events. In fact, people who have experienced depression, even when not in a depressive episode, were also more likely to experience stressful life events (Daley et al., 1997). It is possible that depression may lead to failures in affective and cognitive development which predispose individuals to maladaptive choices increasing the likelihood of experiencing stressors. Empirical findings supporting this hypothesis spanning samples of adults (Harkness, Monroe, Simons, & Thase, 1999), adolescents (Patton, Coffey, Posterino, Carlin, & Bowes, 2003), children of depressed mothers (Adrian & Hammen, 1993), as well as clinical samples of children and adolescents (Rudolph et al., 2000),

Historically, research on depression has always been interested in the differences between event elicited (nonendogenous) and seemingly event independent (endogenous) occurrences of depression. However, concerns about the misleading utilization of the term "endogenous" to signify stress absent have led the DSM to exclusively use qualitative symptoms in defining depression (Hammen, 2005). Understanding the relationship between contextual stressors and the development of depression was further complicated by the experience of multiple stressors, chronic stressors, or stresses during sensitive periods.

Experience of chronic stress is a stronger predictor of internalizing disorders (Hammen, 2005). The kindling/sensitization hypothesis suggests that recurrent episodes of mood disorders may become increasingly independent of stressors as a function of neurobiological changes associated with repeat exposure to stress (Post, 1992). Additionally, the study of adverse childhood experiences (ACEs) suggests a graded relationship with both lifetime and recent depressive disorder. ACEs are associated with increased risk for depression up to even decades after their occurrence (Chapman et al., 2004).

Studying chronic stress, unfortunately, comes with its own methodological challenges. The indeterminate timing of chronic stress and depression make it difficult to evaluate the causal direction of the relationship (Kessler, 1997). Hypotheses suggest that the experience of chronic stress exacerbates the effects of acute stress (Brown & Harris, 1978). However, empirical work suggests that there is a negative interaction between chronic and episodic events, where chronic stress reduces the impact of acute stressors on depressive symptoms. This may represent a saturation effect, whereby those experiencing

chronic stress are less reactive to life events because they are accustomed to dealing with them (Cairney, Boyle, Offord, & Racine, 2003).

Adversity interacts with a variety of individual differences to further inform risk profiles. Diathesis stress theories (Zuckerman, 1999) – or what developmentalists refer to as transactional models (Sameroff & Seifer, 1983) – suggest that particular individuals are more vulnerable to environmental stressors. Vulnerability may represent individual personality characteristic such as negative emotionality, physiological reactivity, or even specific genetic profiles. As discussed above, differential susceptibility model (Belsky & Pluess, 2009) and the biological sensitivity to context theory (Boyce & Ellis, 2005) have expanded upon this notion. Both theories note that individuals should vary in their developmental plasticity and thus their susceptibility to environmental influences, such that some individuals are more sensitive to environmental input than others. Evolutionary developmental theory suggests that natural selection may favor developmental mechanisms which sample the environment for levels of support and stress. This "sampling" will then calibrate the activations and response parameters of the individual's system (Boyce, 2007).

Groundbreaking work over the last few decades has made it clear that early life stress is neither necessary nor sufficient to cause depression. These events likely interact with many other individual and contextual factors to exacerbate risk. A complete causal understanding of depression will likely include multiple levels of vulnerability integrated across many levels of analysis. With the emergence of more sophisticated and capable methods, theories centered on the role of biological mechanism in the relationship between early life adversity and emotional health, such as the neuroimmune network hypothesis (Nusslock & Miller, 2016), are gaining traction. This section attempts to highlight the nuances associated with early adverse experiences and mediating factors but focuses primarily on two of the most well-studied experiences of adversity known to exacerbate risk for depression in children: childhood maltreatment and childhood poverty.

Maltreatment and Neglect

Childhood maltreatment is one of the most challenging experiences that can oppose a child's developmental success. Substantial empirical work suggests that the experience of child maltreatment initiates a probabilistic path of repeated disruptions in the developmental process that may create a cascade of maladaptation across diverse domains of neurobiological, socioemotional, and cognitive development. Further, children who experience maltreatment are likely at increased risk for other forms of adversity (low SES, high neighborhood crime, pollution, overcrowding, fewer quality educational opportunities, and low levels of social capital) also known to created compound risk for maladaptive psychopathological outcomes (Cicchetti, 2013).

Current theories and empirical work often implicate the precipitating role of emotion regulatory behaviors in the development of depression among maltreated children. Emotion regulation is acquired via both intrinsic and extrinsic experiences, primarily within the context of the early parent-child relationship. As children become increasingly sensitive to context, participation and observation of interpersonal exchanges become the foundation upon which various aspects of emotional development are learned. Unfortunately, gross relationship disturbances – exposure to interpersonal violence, negative affect, or even lack of socioemotional input (neglect) – pose a significant threat to a child's ability to recognize, process, and manage emotional experiences. This failure can lead to a cascade of negative developmental disturbances which ultimately result in future psychopathology. The child maltreatment literature has noted deviations in emotion expression, recognition, understanding, and communication (Cicchetti, 2013). Emotion regulation patterns have been found to directly mediate the relationship between maltreatment and depressive symptoms in preschool-aged children (Maughan & Cicchetti, 2002).

The negative effects of child maltreatments can begin as early as infancy, and the impact of earlier experiences of maltreatment has increased

risk for adult psychopathology, specifically internalizing disorders, compared to maltreatment that occurs later in development (Kaplow & Widom, 2007). The experience of maltreatment is often accompanied by the increase of negative emotional expressions in maltreating families. The developmental psychopathology perspective suggests that transactions between the developing child and negative affective environment create deficits in recognizing facial expressions which perpetuate the inability to recognize, label, and gain an understanding of emotions. These decreased emotional competencies can ultimately lead to decreased socioemotional competences. Maltreated kids as young as 30 months showed less accurate recognition of emotions and were hypersensitive to anger (measured via event-related potentials; Cicchetti & Curtis, 2005). This finding was replicated in a sample of 40-month-olds (Curtis & Cicchetti, 2011). Interestingly, in an attempt to extend that work to 15-month-old infants, results suggest that infants displayed a greater ERP reactivity to positive faces. This may represent a developmental process whereby younger children have allocated more resources to processing and detecting novel stimuli. Later in development, increased reactivity probably denotes increased salience (e.g., prelude to threat) of facial affect (Curtis & Cicchetti, 2013). Some normative developmental work proposes that children's capacity to connect specific adult emotional reactions with consequences doesn't begin to occur until the second year of life (Pons, Lawson, Harris, & de Rosnay, 2003). This work further reinforces the importance of attention to developmental periods when key systems regarding adaptive emotion processing and regulation are most sensitive to environmental perturbations.

Child maltreatment has also been shown to have substantial impacts on multiple levels of biological functioning that are related to increased risk for mental and physical illness. These altered biological processes may unfold early in development and set up the potential for lifelong difficulties in physiological regulation of the stress system (Cicchetti, 2013). Some possible biological mediators to the experience of maltreatment include cortisol secretions (Cicchetti & Rogosch, 2001) and glucocorticoid signaling at the cellular level (Palma-Gudiel, Córdova-Palomera, Leza, & Fañanás, 2015). Changes in cortisol secretion may have downstream effects on telomere length. Shorter telomere length is related to increased inflammation, oxidative stress, DNA damage, decreased emotion regulatory processes, and chronic stress exposure (Boeck et al., 2017).

However, it is important to note that at its core developmental psychopathology is interested in the multifinality of the developmental processes. That is, despite having similar starting points, people ultimately display a diverse range of final outcomes. Eventual outcomes are influenced by a complex system of biological and psychological systems of organization, current experiences, personal choices, developmental timing of events, developmental history, and broader social context. It is essential to study the mechanism by which individuals display resilience to psychopathology in order to inform theories about developmental mechanisms and intervention efforts. In fact, epidemiological data suggests staggering resilience and the inherent tendency for human developmental systems to right failures (Masten & Cicchetti, 2016). Only about 55.5% of individuals who report having been abused in childhood were eventually diagnosed with one adult psychiatric disorder (Collishaw et al., 2007). Potential individual differences that contribute to resilience among maltreated children are a tendency toward positive emotionality and its neurological correlates. For example, greater EEG left frontal activity represents brain activity related to positive emotionality and approach behaviors (Curtis & Cicchetti, 2007). Theory suggests that connections with hemispheric EEG asymmetry and its relation to resilience lie in their common link with emotion reactivity and regulation.

Additionally, there is evidence that the relationship between child maltreatment and adult depressive symptoms is moderated by genetic makeup. Recently, genetic research has moved away from a risk only frame work and has been increasingly interested in how genetic makeup may be related to resilience despite experiences of maltreatment. For example, the TAT haplotype

of the corticotrophin-releasing hormone type 1 receptor (CRHR1) gene is considered a potential moderator between childhood maltreatment and adult depression, such that those with the gene had lower rates of depressive symptoms. This finding has been replicated across African American and Caucasian samples (Bradley et al., 2008). Later work suggests a more nuanced relationship between the TAT haplotype and risk. DeYoung, Cicchetti, and Rogosch (2011) found that the TAT haplotype serves as a protective factor for maltreated children only for the most severe forms of maltreatment and may represent a higher risk for depression and other internalizing factors for less severe forms of maltreatment (DeYoung et al., 2011). Theories suggest that CRHR1's role in consolidating memories of emotionally arousing experiences explains its relationship with maltreatment and depression risk (Bradley et al., 2008). Empirical work also supports the potential intervening role of differences in single nucleotide polymorphisms within the OXTR gene. OXTR is a part of the oxytocinergic system which plays a role in anti-inflammatory processes, antioxidant actions, and protecting against telomere shortening and ultimately may contribute to an individual's capacity for resilience in the face of traumatic stress (Boeck et al., 2017).

Poverty and Socioeconomic Status

Currently over 16 million children in the United States under the age of 18 live in households that fall below the poverty line (United States Census Bureau, 2013). Growing up in low-income homes is associated with a wide array of psychosocial risk factors known to increase maladaptive health outcomes. Low socioeconomic status (defined by education, income, and social class) represents the most reliable environmental predictor of disproportionate health burdens. Risk for and severity of maladaptive health functions in a linear stepwise pattern, such that decreases in SES, are related to increased risk for poor health outcomes. This association is pervasive internationally in every society, throughout development, and across history (Boyce, 2007). Low SES and poverty usually serve as a marker for multidimensional risk phenomena by encompassing a general inability to meet basic needs, decreased control over resources, and lack of education. These trends are present whether an individual is experiencing relative (sufficient resources to maintain life but living in disadvantaged circumstances) or absolute (lack of resources to maintain life) poverty (Murali & Oyebode, 2004).

Poor children are at increased risk for multiple additional adverse life events. Poor children experience more violence, more family disruption, increased foster care placement, higher exposure to neighborhood crime, contact with more aggressive peers, lower levels of educational attainment, smaller social networks, fewer organizational involvement, and higher rates of unemployment (Evans, 2004). As described above, chronic stress and increased experiences of adversity associated with poverty are related to biological dysfunction of the stress response system causing potential negative effects on cognition, memory, and affect regulation (Boyce, 2007).

Depression disproportionately affects children from low-income backgrounds (Duncan, Brooks-Gunn, & Klebanov, 1994). Lynch and colleagues (2002) studied SES across the life course and found that those who experienced lower SES in childhood and adulthood had a greater prevalence of hopelessness, depression, and cynicism during middle age. Even those who moved into a higher SES level in adulthood after experiencing low SES in childhood also reported more symptoms of hopelessness, depression, and cynicism, showing residual effects of early life stress on later mental health (Everson, Maty, Lynch, & Kaplan, 2002). This finding has been corroborated across studies (Gilman, Kawachi, Fitzmaurice, & Buka, 2002). Poor emotional control may mediate this association. Lower childhood income has been associated with difficulties inhibiting emotion responses during negative stimuli which were subsequently associated with child-reported internalizing problems (Capistrano, Bianco, & Kim, 2016).

Developmental timing of negative experiences seems to play a precipitating role in biological

change. Low SES during childhood has been associated with structural brain differences including whole-brain gray and white matter volume and thickness. Primary indicators of dysfunction have been in brain regions involved in emotion processing and regulation including the hippocampus, amygdala, and prefrontal cortex (Brito & Noble, 2014). These findings vary from research with institutionally reared children where increases in amygdala volume are often noted. Differences are theorized to be related to institutionally reared children having the opportunity to form intact and healthy attachment relationships. This may represent a fundamental difference in depressive etiology depending on risk experience (Tottenham et al., 2010).

Although emotion dysregulation is a mechanism by which poverty and depression are related, emotion regulation may represent a mechanism of resilience to the development of depression. More broadly, the concept of self-regulation has gained momentum in resilience research, specifically in the context of poverty. Some theories suggest that increased self-regulatory capacity promotes anticipatory planning where individuals anticipate potential adverse experiences and mitigate the experience of stressors. This may effectively turn toxic stressors into controllable events (Aspinwall & Taylor, 1997; Buckner & Waters, 2011). Additionally, the use of primary control coping (problem-solving, emotional expression, emotion regulation) and secondary control coping (acceptance, cognitive restructuring, distraction, and positive thinking) was related to better outcomes for individuals afflicted by poverty. Secondary control coping in particular was linked to lower symptoms of anxiety and depression in adults and children (Wadsworth & Santiago, 2008).

Additional protective mechanisms for children living in poverty include both internal and external mechanisms. Internal mechanisms include easy temperament, alertness, responsivity, sociability, and positive affect. In middle childhood, resilient children are typically good at problem-solving, communication, impulse control, concentration, flexibility in stress response, sociability, independence, and emotion regulation. In adolescence and adulthood, resilient children have an internal locus of control and higher self-esteem and positive core values, are more socially perceptive, and are more nurturing and responsive. Resilient children from low SES backgrounds also typically display higher IQs across development. External mechanisms of resilience typically include competent care giving, a bond with one important stable caregiver who provides positive attention, and general availability to local social resources (Buckner & Waters, 2011; Masten & Garmezy, 1985).

Other Forms of Adversity

An in-depth analysis of all of the potential adverse experiences that potentiate risk for depression is beyond the scope of this chapter. Additional stressors commonly studied in child developmental psychopathology include death of a parent or loved one (Slavich, Monroe, & Gotlib, 2011), the experience of natural disasters (Foa, Stein, & McFarlane, 2006; Tang, Liu, Liu, Xue, & Zhang, 2014), war (Thabet, Abed, & Vostanis, 2004), neighborhood conflict (Latkin & Curry, 2003), divorce and marital discord (Vousoura, Verdeli, Warner, Wickramaratne, & Baily, 2012), parental mental illness and substance abuse (Rasic, Hajek, Alda, & Uher, 2013), and/or general violence (Cisler et al., 2012; Kessler & Magee, 1993). It is clear that childhood adversities have strong associations with depression at all life course stages, cross culturally (Kessler et al., 2010). However, various adverse experiences may have differential effects on child social, emotional, cognitive, and biological functioning, ultimately bolstering risk for depressive psychopathology. Each of these individual risk factors also may have separate protective factors which mitigate risk for the development of disorders. For example, after natural disasters, social capital and social cohesion mitigate risks for depression in individuals in the community (Buckner & Waters, 2011). It is essential that we study all of these potential precipitating factors in order to understand both the common and differential impacts of stress on system functioning.

In particular, this literature stresses the importance of a developmental psychopathology perspective in which we utilize multiple levels of analysis, including environmental and social influences, across various ages in order to more fully understand both normative and maladaptive development arises.

Prevention Interventions for Depressive Disorders

Translational Research

In order to truly effect change and improve the lives of those suffering from mental illness, the vast expanse of literature must be translated to practical use in the prevention and treatment of psychopathology. According to the Center for Disease Control and Prevention (CDC), suicide was the second leading cause of death among 10- to 34-year-olds in 2015 (CDC, 2016a). Despite the continuing depth of depression research, the rate of suicide continues to climb, rather than fall (CDC, 2016b). In the last two decades, the National Institutes of Mental Health (NIMH) has advocated the use of translational research, the practice of research that can easily be used in the improvement of diagnosis, prevention, and treatment of mental health illnesses (e.g., Insel, 2009b). Insel (2009a) outlines the drastic difference in understanding of psychiatric disorders today than when many treatments were developed in the past. To address the ineffectiveness of medication and treatment, he calls for the use of current technologies to gain a deeper understanding of the pathophysiology and developmental stages of mental disorders (Insel, 2009a). Child development research has produced a sizeable literature documenting stage-specific developmental tasks and the evolution of biology and cognition throughout childhood (Gunnar & Cicchetti, 2009). As outlined by Sroufe and Rutter (1984), understanding the factors that predict a trajectory of illness will provide insight into where and when we can intervene to prevent the establishment of the disorder (Sroufe & Rutter, 1984).

Prevention Trials

In this chapter, several risk factors for the development of depression have been identified, including genetic risk, social relationships, comorbidity, and biological functioning. Preventive interventions often also zero in on specific processes of self-regulation. These risk factors are not exhaustive, nor do they act independently, but they provide a robust scope of targets for preventive intervention. Preventive interventions can intervene on a general population (a universal prevention), a population at higher risk for a disorder (a selective prevention), or populations who have begun presenting with symptoms (an indicated prevention; (Mrazek & Haggerty, 1994). Preventive trials serve to bolster intervention while advancing the basic science underlying mental health.

As we have described, childhood maltreatment is one precursor to an insecure attachment relationship. Cicchetti, Rogosch, and Toth (2006) implemented a randomized control trial (RCT) using two theory- and research-based preventive interventions. The interventions either taught mothers about child development and parenting skills or engaged parents and children together in therapy that focused on the attachment relationship. Both intervention groups had a marked increase in rates of secure attachment, compared to no improvement in dyads receiving standard care. This study identifies effective treatment sources and displays the malleability of attachment relationships (Cicchetti et al., 2006). Longitudinal work found that effects can differentiate over time. The effects of the child-parent intervention were sustained in a 12-month follow-up, while the effects of the parent-only intervention did not (Pickreign Stronach, Toth, Rogosch, & Cicchetti, 2013).

In another successful preventive trial, Garber and colleagues (2009) conducted an indicated RCT examining the effectiveness of a cognitive behavioral therapy (CBT) for adolescents with a history of depression or currently subclinical depressive symptoms, and a parent with current or prior depression. The therapy trained participants to challenge negative thoughts and improve

problem-solving skills. Across four sites, subjects participating in the prevention program showed significant reductions in depressive episodes and symptomatology compared to adolescents receiving care as usual. Multisite research is critical in understanding generalizability of interventions across populations. However, the treatment was not more effective than care as usual if the parent had current depression. This group difference suggests a need for both parent and adolescent treatment (Garber et al., 2009). More broadly, it indicates a need to consider moderators affecting intervention effectiveness.

Regardless of focus, an intervention loses much of its efficacy without strong fidelity. Gladstone and Beardslee (2009) reviewed a number of specific, empirically based depression prevention programs. Although they differ in targeted mechanism and treatment style, every program had strengths in intervention structure, manualizing protocols, and careful training. Patterns emerging from the review of many programs also suggest the importance of targeted and indicated prevention over universal prevention and efforts toward family-based intervention (Gladstone & Beardslee, 2009).

Treatment Interventions of Depressive Disorders

Therapies addressing the impact of depression once it has already emerged have been systematically studied and implemented for much longer than methods of prevention.

The majority of evidence-based treatments are time-limited therapies, or treatments that are delivered according to a manualized protocol and occur during a discrete episode of care (Weisz, Sandler, Durlak, & Anton, 2005). Considering the wealth of literature supporting these treatments, they are often the first line of defense when mental health illness arises. Indeed, in the most recent meta-analysis of treatments, Weisz and colleagues (2017) find beneficial effects overall in youth psychological therapy. The meta-analysis assessed studies spanning 50 years to determine the effectiveness of empirical treatments. Despite the overarching benefit, the paper finds the state of therapy for depression to be somewhat alarming: for depression only, the beneficial effects drop significantly, and in many cases, therapy fares worse than control conditions. By demonstrating no difference between children and adolescents, the meta-analysis also refutes that adolescents may be more treatment resistant due to greater autonomy or more complex social and emotional factors (Weisz et al., 2017). This disappointing finding, in conjunction with continually high rates of depression and suicide in our population, points to an urgent need for continued and progressive treatment development.

Psychotherapy

In recent decades, cognitive behavioral therapy (CBT) has been considered among the most effective treatment styles (American Psychiatric Association, 2010). A cognitive model of depression claims that depression is facilitated by a negative self-view, made up of dysfunctional thoughts and information-processing biases (Beck et al., 1979). CBT aims to ameliorate depression by reducing these negative automatic thoughts and encouraging behaviors that increase environmental reinforcement. Some reviews of treatment literature stand by the effectiveness of CBT. Klein and Jacobs (2007) address the apparent decline in efficacy by conducting a meta-analysis of CBT in depressed adolescents with less heterogeneity in selected studies. The analysis still finds a significant effect of treatment, but evidence for declining effectiveness (Klein & Jacobs, 2007). Although this provides some hope for existing treatments, results still show relatively small effects and mixed conclusions compared to other meta-analyses (Weisz et al., 2017; Weisz, McCarty, & Valeri, 2006).

Moving forward, there is a need to explore novel avenues or better understand traditional methods to facilitate recovery from depression. In examining treatment type as a moderator between psychotherapy and symptomatology, Weisz and colleagues found a mixed picture, with

no specific treatment emerging as most effective (Weisz et al., 2017). Research is beginning to progress into newer styles of therapy, tapping into contemplative practices and changes in physical behavior. Given the relatively recent influx of research in emotion regulation, interest has also sparked in directly treating emotional processing and regulation. Some have suggested integrating emotion regulation skills into cognitive behavioral treatments. CBT targets certain negative biases, but these may not be generalizable to all emotions. Incorporating emotion-focused content into CBT treatments could potentially expand efficacy (for a review, see Trosper, Buzzella, Bennett, & Ehrenreich, 2009).

Alternative Treatments

Researchers have also explored the benefits of activities outside of direct psychotherapy. Exercise has repeatedly been shown to have antidepressant effects, while sedentary behavior is shown to have deleterious effects on health. However, much of this research is limited to adults (Hallgren et al., 2016). Other physical practices have found their way into the youth literature. The implementation of mindfulness-based practices, including meditation, yoga, and others, has spiked in both youth and adults. Adult research shows that these methods can benefit health and attention and reduce pain and symptoms of depression and anxiety (e.g., Kabat-Zinn, 2003). Biological research has found that meditation reduces stress reactivity and immunoreactivity and associated neural regions (Davidson et al., 2003; Tang et al., 2007). The nature of the findings has prompted understandable enthusiasm for mindfulness-based practices to treat psychopathology. However, a recent review points to both limited quantity and quality of literature examining effects of meditative practices (Greenberg & Harris, 2012). By understanding the cultural traditions surrounding these practices, formalizing implementation strategies, and continuing high-quality research on contemplative interventions, we can maximize the benefits from this promising practice.

Personalized Medicine

As more basic science research continues to identify risk factors and individual differences in the presentation of mental illness, there is a growing interest in personalized medicine. Personalized medicine uses an amalgam of individual factors to inform a treatment plan that includes one or a combination of evidence-based treatments, and how they are delivered. The treatment plan changes according to the patient's progress. Personalized interventions can adapt evidence-based therapy for specific subgroups, such as a group experiencing a certain risk factor or an ethnic group. This provides space for empirically based treatments to work in groups on which they were not explicitly tested (for a review of personalized medicine in youth, see Ng & Weisz, 2016).

Growing interest in personalized medicine points to a greater positive trend. Increasingly, researchers are calling for more explicit bridges between basic science and clinical implementation. Integrated models of evidence-based prevention and intervention will maximally impact the prevalence of depression rates by decreasing its effects at every stage and reaching individuals from multiple contexts (Weisz et al., 2005). By facilitating conversation between scientists in every field (e.g., Moffitt & The Klaus-Graw 2012 Think Tank, 2013), both basic research and prevention intervention will be strengthened.

Conclusions and Future Directions

Philosophy and research have chased after the etiology and appropriate treatment of depression for centuries, only to find that the condition is highly heterogeneous. No one treatment has effectively reduced prevalence, and in fact rates of depression and suicide among youth are climbing. Although progress has been made, the field requires innovating minds and collaborations to effect real, concrete change in individual lives. Critically, laboratory studies need to be increasingly translational, and for efforts to be made to

implement findings into clinical settings. Understanding heritable and environmental risk factors gives mental health professionals an upper hand in intervening quickly and early. Importantly, the study of individuals who develop adaptively despite exposure to risk factors is critical to understanding mechanisms of resilience.

Mental health research continues to occur among populations that aren't representative of communities at risk for developing psychopathology. Depression is a disorder shaped by one's social context, so assessment of cultural and social factors is necessary. Although an assessment of psychotherapies didn't find ethnicity to be a moderator in treatment effectiveness, it was noted that many papers didn't report ethnicity or had a majority Caucasian sample (Weisz et al., 2017). Rather than showing a level playing field, this indicates a dearth of literature about how culture shapes an individual's development.

In order to make the strongest public health impact, science has to consider access to care, quality of actual care, and the implementation of scientific findings. Many individuals do not have access to the services they need, and often these individuals are from communities at greatest risk for developing psychopathology. Further, stigmatization of mental illness continues to be a pervasive cultural concern which can hold individuals back from seeking treatment (Hinshaw & Cicchetti, 2000). In the general public, there is debate surrounding the legitimacy of medication for depression, as well as the legitimacy of alternative treatments with empirical support, such as psychotherapy, physical activity, and contemplative practices. Personalized treatment provides the opportunity to use methods that will be most effective for an individual. Universal preventive programs that target general populations play the joint role of reducing risk for depression and fighting stigma. In sum, an interdisciplinary approach to understanding a child's development, stages susceptible to risk for mental illness, and mechanisms of resilience are key steps in the basic science of depression. To truly promote mental health in our youth, we must translate this knowledge to treatment, consider individual factors of risk, and take a universal approach of both prevention and treatment.

References

Abramson, L. Y., Metalsky, G. I., & Alloy, L. B. (1989). Hopelessness depression: A theory-based subtype of depression. *Psychological Review, 96*(2), 358.

Abramson, L. Y., Seligman, M. E., & Teasdale, J. D. (1978). Learned helplessness in humans: Critique and reformulation. *Journal of Abnormal Psychology, 87*(1), 49.

Abulizi, X., Pryor, L., Michel, G., Melchior, M., Van Der Waerden, J., & EDEN Mother–Child Cohort Study Group. (2017). Temperament in infancy and behavioral and emotional problems at age 5.5: The EDEN mother-child cohort. *PLoS One, 12*(2), e0171971.

Adrian, C., & Hammen, C. (1993). Stress exposure and stress generation in children of depressed mothers. *Journal of Consulting and Clinical Psychology, 61*(2), 354.

Ainsworth, M. D. S., Blehar, M. C., Waters, E., & Wall, S. (1978). *Patterns of attachment*. Hillsdale, NJ: Erlbaum.

Akiskal, H. S., & McKinney, W. T. (1975). Overview of recent research in depression: Integration of ten conceptual models into a comprehensive clinical frame. *Archives of General Psychiatry, 32*(3), 285–305.

Akse, J., Hale, W. W., III, Engels, R. C. M. E., Raaijmakers, Q. A. W., & Meeus, W. H. J. (2007). Stability and change in personality type membership and anxiety in adolescence. *Journal of Adolescence, 30*, 813–834.

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review, 30*, 217–237.

Alloy, L. B., & Abramson, L. Y. (1979). Judgment of contingency in depressed and nondepressed students: Sadder but wiser? *Journal of Experimental Psychology, 108*(4), 441.

American Psychiatric Association. (1980). *Diagnostic and statistical manual of mental health disorders (DSM-III)*. Washington, DC: American Psychiatric Association.

American Psychiatric Association. (2010). *Practice guideline for the treatment of patients with major depressive disorder* (3rd ed.). Arlington, VA: American Psychiatric Association.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. Washington, DC: American Psychiatric Pub.

Anderson, E. R., & Hope, D. A. (2008). A review of the tripartite model for understanding the link between anxiety and depression in youth. *Clinical Psychology Review, 28*(2), 275–287.

Andover, M. S., Morris, B. W., Wren, A., & Bruzzese, M. E. (2012). The co-occurrence of non-suicidal

self-injury and attempted suicide among adolescents: Distinguishing risk factors and psychosocial correlates. *Child and Adolescent Psychiatry and Mental Health, 6*(1), 11.

Arnett, J. J. (1999). Adolescent storm and stress, reconsidered. *American Psychologist, 54*, 317–326.

Arseneault, L., Bowes, L., & Shakoor, S. (2010). Bullying victimization in youths and mental health problems: 'Much ado about nothing'? *Psychological Medicine, 40*, 717–729.

Aspinwall, L. G., & Taylor, S. E. (1997). A stitch in time: Self-regulation and proactive coping. *Psychological Bulletin, 121*(3), 417.

Avenevoli, S., Swendsen, J., He, J. P., Burstein, M., & Merikangas, K. R. (2015). Major depression in the National Comorbidity Survey–Adolescent Supplement: Prevalence, correlates, and treatment. *Journal of the American Academy of Child & Adolescent Psychiatry, 54*(1), 37–44.

Barzilay, S., & Apter, A. (2014). Predictors of suicide in adolescents and adults with mood and common comorbid disorders. *Neuropsychiatry, 4*(1), 81.

Barzilay, S., Feldman, D., Snir, A., Apter, A., Carli, V., Hoven, C. W., … Wasserman, D. (2015). The interpersonal theory of suicide and adolescent suicidal behavior. *Journal of Affective Disorders, 183*, 68–74.

Beach, S. R. H., Lei, M. K., Simons, R. L., Barr, A. B., Simons, L. G., Ehrlich, K., … Philbert, R. A. (2017). When inflammation and depression go together: The longitudinal effects of parent-child relationships. *Development and Psychopathology, 29*, 1969–1986.

Beauchaine, T. (2001). Vagal tone, development, and Gray's motivational theory: Toward an integrated model of autonomic nervous system functioning in psychopathology. *Development and Psychopathology, 13*, 183–214.

Beck, A. T. (1967). *Depression. Clinical, experimental and theoretical aspects*. New York, NY: Hoeber.

Beck, A. T., Rush, A. J., Shaw, B. F., & Emery, G. (1979). *Cognitive therapy of depression*. New York, NY: Guilford.

Belsky, J., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2007). For better and for worse: Differential susceptibility to environmental influences. *Current Directions in Psychological Science, 16*(6), 300–304.

Belsky, J., & Fearon, R. M. P. (2002). Infant–mother attachment security, contextual risk, and early development: A moderational analysis. *Development and Psychopathology, 14*(2), 293–310.

Belsky, J., Pasco Fearon, R. M., & Bell, B. (2007). Parenting, attention and externalizing problems: Testing mediation longitudinally, repeatedly and reciprocally. *Journal of Child Psychology and Psychiatry, 48*(12), 1233–1242.

Belsky, J., & Pluess, M. (2009). Beyond diathesis stress: Differential susceptibility to environmental influences. *Psychological Bulletin, 135*(6), 885.

Belsky, J., & Pluess, M. (2013). Beyond risk, resilience, and dysregulation: Phenotypic plasticity and human development. *Development and Psychopathology, 25*(4pt2), 1243–1261.

Boeck, C., Krause, S., Karabatsiakis, A., Schury, K., Gündel, H., Waller, C., & Kolassa, I. T. (2017). History of child maltreatment and telomere length in immune cell subsets: Associations with stress-and attachment-related hormones. *Development and Psychopathology, 3*(20), 539–551.

Boland, R., & Keller, M. (2009). Course and outcome of depression. In I. Gotlib & C. Hammen (Eds.), *Handbook of depression* (pp. 23–44). New York, NY: Guilford Press.

Bond, L., Carlin, J. B., Thomas, L., Rubin, K., & Patton, G. (2001). Does bullying cause emotional problems? A perspective study of young teenagers. *British Medical Journal, 323*, 480–484.

Borges, G., Anthony, J. C., & Garrison, C. Z. (1995). Methodological issues relevant to epidemiologic investigations of suicidal behaviors of adolescents. *Epidemiologic Reviews, 17*(1), 228–239.

Borowsky, I. W., Taliaferro, L. A., & McMorris, B. J. (2013). Suicidal thinking and behavior among youth involved in verbal bullying: Risk and protective factors. *Journal of Adolescent Health, 53*, 54–512.

Bowlby, J. (1969). *Attachment and loss: Vol. 1 attachment*. New York, NY: Basic Books.

Bowlby, J. (1980). *Attachment and loss: Vol. 3. Loss: Sadness and depression*. New York, NY: Basic Books.

Boyce, W. T. (2007). A biology of misfortune: Stress reactivity, social context, and the ontogeny of psychopathology in early life. In A. S. Masten (Ed.), *Multilevel dynamics in developmental psychopathology: Pathways to the future* (Vol. 34, pp. 45–82). Mahwah, NJ: Lawrence Erlbaum Associates Inc.

Boyce, W. T., & Ellis, B. J. (2005). Biological sensitivity to context: I. An evolutionary-developmental theory of the origins and functions of stress reactivity. *Development and Psychopathology, 17*(2), 271–301.

Bradley, R. G., Binder, E. B., Epstein, M. P., Tang, Y., Nair, H. P., Liu, W., … Stowe, Z. N. (2008). Influence of child abuse on adult depression: Moderation by the corticotropin-releasing hormone receptor gene. *Archives of General Psychiatry, 65*(2), 190–200.

Bress, J. N., Meyer, A., & Hajcak, G. (2013). Differentiating anxiety and depression in children and adolescents: Evidence from event-related brain potentials. *Journal of Clinical Child and Adolescent Psychology, 7*, 37–41.

Bridge, J. A., Asti, L., Horowitz, L. M., Greenhouse, J. B., Fontanella, C. A., Sheftall, A. H., … Campo, J. V. (2015). Suicide trends among elementary school–aged children in the United States from 1993 to 2012. *JAMA Pediatrics, 169*(7), 673–677.

Brito, N. H., & Noble, K. G. (2014). Socioeconomic status and structural brain development. *Frontiers in Neuroscience, 8*, 276.

Brown, B. B., & Larson, J. (2009). Peer relationships in adolescence. In R. M. Lerner & L. Steinberg (Eds.), *Handbook of adolescent psychology, Vol 2: Contextual*

influences on adolescent development (3rd ed., pp. 74–103). Hoboken, NJ: Wiley.

Brown, G. W., & Harris, T. (1978). Social origins of depression: A reply. *Psychological Medicine, 8*(4), 577–588.

Brumariu, L. E., & Kerns, K. A. (2010). Parent–child attachment and internalizing symptoms in childhood and adolescence: A review of empirical findings and future directions. *Development and Psychopathology, 22*, 177–203.

Buckner, J. C., & Waters, J. S. (2011). Resilience in the context of poverty. In S. M. Southwick, B. T. Litz, D. Charney, & M. J. Friedman (Eds.), *Resilience and mental health: Challenges across the lifespan* (pp. 264–275). Cambridge, UK: Cambridge University Press.

Butler, E. A., Lee, T. L., & Gross, J. J. (2007). Emotion regulation and culture: Are the social consequences of emotion suppression culture specific. *Emotion, 7*, 30–48.

Cairney, J., Boyle, M., Offord, D. R., & Racine, Y. (2003). Stress, social support and depression in single and married mothers. *Social Psychiatry and Psychiatric Epidemiology, 38*(8), 442–449.

Capistrano, C. G., Bianco, H., & Kim, P. (2016). Poverty and internalizing symptoms: The indirect effect of middle childhood poverty on internalizing symptoms via an emotional response inhibition pathway. *Frontiers in Psychology, 7*, 1242.

Casey, B., Jones, R. M., & Somerville, L. H. (2011). Braking and accelerating of the adolescent brain. *Journal of Research on Adolescence, 21*(1), 21–33.

Caspi, A., Hariri, A. R., Holmes, A., Uher, R., & Moffitt, T. E. (2010). Genetic sensitivity to the environment: The case of the serotonin transporter gene and its implications for studying complex diseases and traits. *Focus, 8*(3), 398–416.

Caspi, A., Roberts, B. W., & Shiner, R. L. (2005). Personality development: Stability and change. *Annual Review of Psychology, 56*, 453–484.

Caspi, A., Sugden, K., Moffitt, T. E., Taylor, A., Craig, I. W., Harrington, H., … Poulton, R. (2003). Influence of life stress on depression: Moderation by a polymorphism in the 5-HTT gene. *Science, 301*(5631), 386–389.

Cassidy, J. (1994). Emotion regulation: Influences on attachment relationships. *Monographs of the Society for Research in Child Development, 59*(Serial No. 240), 228–249.

Causadias, J. M. (2013). A roadmap for the integration of culture into developmental psychopathology. *Development and Psychopathology, 25*(4pt2), 1375–1398.

Centers for Disease Control and Prevention. (2010). WISQARS leading causes of death reports, 1999–2006. *National Center for Health Statistics (NCHS), National Vital Statistics System*, *200*(7).

Centers for Disease Control and Prevention. (2014). WISQARS Leading Causes of Death Reports, National and Regional, 1999–2010. *National Center for Health Statistics, National Vital Statistics System.* http://webappa.cdc.gov/sasweb/ncipc/leadcaus10_us.html. Accessed 14 Nov.

Centers for Disease Control and Prevention. (2016a). Mortality in the United States, 2015. *National Center for Health Statistics (NCHS) Data Brief, 267*.

Centers for Disease Control and Prevention. (2016b). Increase in Suicide in the United States, 1999–2014. *National Center for Health Statistics (NCHS) Data Brief, 241*.

Chapman, D. P., Whitfield, C. L., Felitti, V. J., Dube, S. R., Edwards, V. J., & Anda, R. F. (2004). Adverse childhood experiences and the risk of depressive disorders in adulthood. *Journal of Affective Disorders, 82*(2), 217–225.

Charney, D. S., Barlow, D. H., Botteron, K., Cohen, J. D., Goldman, D., Gur, R. E., … Zalcman, S. J. (2002). Neuroscience research agenda to guide development of a pathophysiologically based classification system. In D. J. Kupfer, M. B. First, & D. A. Regier (Eds.), *A research agenda for DSM-V* (pp. 31–83). Arlington, VA: American Psychiatric Association.

Chen, M. C., Joormann, J., Hallmayer, J., & Gotlib, I. H. (2009). Serotonin transporter polymorphism predicts waking cortisol in young girls. *Psychoneuroendocrinology, 34*(5), 681–686.

Chentsova-Dutton, Y., Chu, J., Tsai, J. L., Rottenberg, J., Gross, J. J., & Gotlib, I. (2007). Depression and emotional reactivity: Variation among Asian Americans of East Asian descent and European Americans. *Journal of Abnormal Psychology, 116*(4), 776–785.

Chentsova-Dutton, Y. E., Tsai, J. L., & Gotlib, I. (2010). Further evidence for the cultural norm hypothesis: Positive emotion in depressed and control European American and Asian American women. *Cultural Diversity and Ethnic Minority Psychology, 16*(2), 284–295.

Cicchetti, D. (1984). The emergence of developmental psychopathology. *Child Development, 55*, 1–7.

Cicchetti, D. (1993). Developmental psychopathology: Reactions, reflections, projections. *Developmental Review, 13*, 471–502.

Cicchetti, D. (2013). Annual research review: Resilient functioning in maltreated children–past, present, and future perspectives. *Journal of Child Psychology and Psychiatry, 54*(4), 402–422.

Cicchetti, D. (2016). A multilevel developmental psychopathology systems perspective on depression. In T. Frodl (Ed.), *Systems neuroscience in depression* (pp. 3–28). Cambridge, MA: Elsevier, Academic Press.

Cicchetti, D., Ackerman, B. P., & Izard, C. E. (1995). Emotions and emotion regulation in developmental psychopathology. *Development and Psychopathology, 7*(1), 1–10.

Cicchetti, D., & Curtis, W. J. (2005). An event-related potential study of the processing of affective facial expressions in young children who experienced maltreatment during the first year of life. *Development and Psychopathology, 17*(3), 641–677.

Cicchetti, D., & Rogosch, F. A. (1996). Equifinality and multifinality in developmental psychopathology. *Development and Psychopathology, 8*, 597–600.

Cicchetti, D., & Rogosch, F. A. (2001). The impact of child maltreatment and psychopathology on neuroendocrine functioning. *Development and Psychopathology, 13*(4), 783–804.

Cicchetti, D., Rogosch, F. A., & Toth, S. L. (1998). Maternal depressive disorder and contextual risk: Contributions to the development of attachment insecurity and behaviour problems in toddlerhood. *Development and Psychopathology, 10*, 283–300.

Cicchetti, D., Rogosch, F. A., & Toth, S. L. (2006). Fostering secure attachment in infants in maltreating families through preventive interventions. *Development and Psychopathology, 18*(3), 623–649.

Cicchetti, D., & Schneider-Rosen, K. (1984a). Theoretical and empirical considerations in the investigation of the relationship between affect and cognition in atypical populations of infants: Contributions to the formulation of an integrative theory of development. In C. Izard, J. Kagan, & R. Zajonc (Eds.), *Emotion, cognition, and behavior* (pp. 366–406). New York, NY: Cambridge University Press.

Cicchetti, D., & Schneider-Rosen, K. (1984b). Toward a transactional model of childhood depression. *New Directions for Child and Adolescent Development, 1984*(26), 5–27.

Cicchetti, D., & Schneider-Rosen, K. (1986). An organizational approach to childhood depression. In M. Rutter, C. Izard, & P. Read (Eds.), *Depression in young people: Developmental and clinical perspectives* (pp. 71–134). New York, NY: Guilford.

Cicchetti, D., & Toth, S. L. (1998). The development of depression in children and adolescents. *American Psychologist, 53*(2), 221.

Cicchetti, D., & Toth, S. L. (2009). A developmental psychopathology perspective on depression in adolescents. In S. Nolen-Hoeksema & L. M. Hilt (Eds.), *The handbook for depression in adolescents* (pp. 3–32). New York, NY: Routledge.

Cicchetti, D., Toth, S. L., & Handley, E. D. (2015). Genetic moderation of interpersonal psychotherapy efficacy for low-income mothers with major depressive disorder: Implications for differential susceptibility. *Development and Psychopathology, 27*(1), 19–35.

Cisler, J. M., Begle, A. M., Amstadter, A. B., Resnick, H. S., Danielson, C. K., Saunders, B. E., & Kilpatrick, D. G. (2012). Exposure to interpersonal violence and risk for PTSD, depression, delinquency, and binge drinking among adolescents: Data from the NSA-R. *Journal of Traumatic Stress, 25*(1), 33–40.

Claes, L., Klonsky, E. D., Muehlenkamp, J., Kuppens, P., & Vandereycken, W. (2010). The affect-regulation function of nonsuicidal self-injury in eating-disordered patients: Which affect states are regulated? *Comprehensive Psychiatry, 51*(4), 386–392.

Clark, L. A., & Watson, D. (1991). Tripartite model of anxiety and depression: Psychometric evidence and taxonomic implications. *Journal of Abnormal Psychology, 100*(3), 316.

Coan, J. A., & Allen, J. J. B. (2003). The state and trait nature of frontal EEG asymmetry in emotion. *The Asymmetrical Brain*, 565–615.

Cohn, J. F., & Tronick, E. (1989). Specificity of infants' response to mothers' affective behavior. *Journal of the American Academy of Child and Adolescent Psychiatry, 28*(2), 242–248.

Colich, N. L., Ho, T. C., Ellwood-Lowe, M. E., Foland-Ross, L. C., Sacchet, M. D., LeMoult, J. L., & Gotlib, I. H. (2017). Like mother like daughter: Putamen activation as a mechanism underlying intergenerational risk for depression. *Social Cognitive and Affective Neuroscience, 12*(9), 1480–1489.

Collishaw, S., Pickles, A., Messer, J., Rutter, M., Shearer, C., & Maughan, B. (2007). Resilience to adult psychopathology following childhood maltreatment: Evidence from a community sample. *Child Abuse & Neglect, 31*(3), 211–229.

Compas, B. E., Connor-Smith, J., & Jaser, S. S. (2004). Temperament, stress reactivity, and coping: Implications for depression in childhood and adolescence. *Journal of Clinical Child & Adolescent Psychology, 33*, 21–31.

Compas, B. E., Orosan, P. G., & Grant, K. E. (1993). Adolescent stress and coping: Implications for psychopathology during adolescence. *Journal of Adolescence, 16*(3), 331–349.

Conner, K. R., Sorensen, S., & Leonard, K. E. (2005). Initial depression and subsequent drinking during alcoholism treatment. *Journal of Studies on Alcohol, 66*(3), 401–406.

Conradt, E., Measelle, J., & Ablow, J. C. (2013). Poverty, problem behavior, and promise: Differential susceptibility among infants reared in poverty. *Psychological Science, 24*(3), 235–242.

Converge Consortium. (2015). Sparse whole genome sequencing identifies two loci for major depressive disorder. *Nature, 523*(7562), 588.

Copeland, W., Shanahan, L., Miller, S., Costello, E. J., Angold, A., & Maughan, B. (2010). Outcomes of early pubertal timing in young women: A prospective population-based study. *American Journal of Psychiatry, 167*(10), 1218–1225.

Costello, D. M., Swendsen, J., Rose, J. S., & Dierker, L. C. (2008). Risk and protective factors associated with trajectories of depressed mood from adolescence to early adulthood. *Journal of Consulting and Clinical Psychology, 76*(2), 173.

Craig, W. M. (1998). The relationship among bullying, victimization, depression, anxiety, and aggression in elementary school children. *Personality and Individual Differences, 24*(1), 123–130.

Crick, N. R. (1995). Relational aggression: The role of intent attributions, feelings of distress, and provocation type. *Development and Psychopathology, 7*, 313–322.

Cummings, E. M., & Davies, P. T. (1994). Maternal depression and child development. *Journal of Child Psychology and Psychiatry, 35*(1), 73–122.

Cummings, J. R., Case, B. G., Ji, X., Chae, D. H., & Druss, B. G. (2014). Racial/ethnic differences in

perceived reasons for mental health treatment in US adolescents with major depression. *Journal of the American Academy of Child & Adolescent Psychiatry, 53*(9), 980–990.

Curhan, K. B., Sims, T., Markus, H. R., Kitayama, S., Karasawa, M., Kawakami, N., … Ryff, C. R. (2014). Just how bad negative affect is for your health depends on culture. *Psychological Science, 25*, 2277–2280.

Curran, G. M., Booth, B. M., Kirchner, J. E., & Deneke, D. E. (2007). Recognition and management of depression in a substance use disorder treatment population. *The American Journal of Drug and Alcohol Abuse, 33*(4), 563–569.

Curtis, W., & Cicchetti, D. (2007). Emotion and resilience: A multilevel investigation of hemispheric electroencephalogram asymmetry and emotion regulation in maltreated and nonmaltreated children. *Development and Psychopathology, 19*(3), 811–840.

Curtis, W. J., & Cicchetti, D. (2011). Affective facial expression processing in young children who have experienced maltreatment during the first year of life: An event-related potential study. *Development and Psychopathology, 23*(2), 373–395.

Curtis, W. J., & Cicchetti, D. (2013). Affective facial expression processing in 15-month-old infants who have experienced maltreatment: An event-related potential study. *Child Maltreatment, 18*(3), 140–154.

Daley, S. E., Hammen, C., Burge, D., Davila, J., Paley, B., Lindberg, N., & Herzberg, D. S. (1997). Predictors of the generation of episodic stress: A longitudinal study of late adolescent women. *Journal of Abnormal Psychology, 106*(2), 251.

Dalton, V. S., Kolshus, E., & McLoughlin, D. M. (2014). Epigenetics and depression: Return of the repressed. *Journal of Affective Disorders, 155*, 1–12.

Danese, A., & McEwen, B. S. (2012). Adverse childhood experiences, allostasis, allostatic load, and age-related disease. *Physiological Behavior, 106*, 29–39.

Danese, A., Moffitt, T. E., Pariante, C. M., Ambler, A., Poulton, R., & Caspi, A. (2008). Elevated inflammation levels in depressed adults with a history of childhood maltreatment. *Archives of General Psychiatry, 65*, 409–415.

Darche, M. A. (1990). Psychological factors differentiating self-mutilating and non-self-mutilating adolescent inpatient females. *Psychiatric Hospital, 21*(1), 31–35.

Davidson, R. J. (1992). Anterior cerebral asymmetry and the nature of emotion. *Brain and Cognition, 20*(1), 125–151.

Davidson, R. J. (1998). Affective style and affective disorders: Perspectives from affective neuroscience. *Cognition and Emotion, 12*(3), 307–330.

Davidson, R. J., Kabat-Zinn, J., Schumacher, J., Rosenkranz, M., Muller, D., Santorelli, S. F., … Sheridan, J. F. (2003). Alterations in brain and immune function produced by mindfulness meditation. *Psychosomatic Medicine, 65*(4), 564–570.

Davis, M., & Suveg, C. (2014). Focusing on the positive: A review of the role of child positive affect in developmental psychopathology. *Clinical Child and Family Psychology Review, 17*(2), 97–124.

De Bolle, M., Beyers, W., De Clercq, B., & De Fruyt, F. (2012). General personality and psychopathology in referred and nonreferred children and adolescents: An investigation of continuity, pathoplasty, and complication models. *Journal of Abnormal Psychology, 121*(4), 958.

De Pauw, S. S., & Mervielde, I. (2010). Temperament, personality and developmental psychopathology: A review based on the conceptual dimensions underlying childhood traits. *Child Psychiatry & Human Development, 41*(3), 313–329.

Denham, S. A., Bassett, H. H., & Wyatt, T. (2007). The socialization of emotional competence. In J. Grusec & P. Hastings (Eds.), *The handbook of socialization* (pp. 614–637). New York, NY: Guilford Press.

Dettling, A. C., Gunnar, M. R., & Donzella, B. (1999). Cortisol levels of young children in full-day childcare centers: Relations with age and temperament. *Psychoneuroendocrinology, 24*, 519–536.

DeYoung, C. G., Cicchetti, D., & Rogosch, F. A. (2011). Moderation of the association between childhood maltreatment and neuroticism by the corticotropin-releasing hormone receptor 1 gene. *Journal of Child Psychology and Psychiatry, 52*(8), 898–906.

Dienes, K. A., Hazel, N. A., & Hammen, C. L. (2013). Cortisol secretion in depressed, and at-risk adults. *Psychoneuroendocrinology, 38*(6), 927–940.

Doom, J. R., Doyle, C. M., & Gunnar, M. R. (2016). Social stress buffering by friends in childhood and adolescence: Effects on HPA and oxytocin activity (2017). *Social Neuroscience, 12*(1), 8.

Dougherty, L. R., Klein, D. N., Durbin, C. E., Hayden, E. P., & Olino, T. M. (2010). Temperamental positive and negative emotionality and children's depressive symptoms: A longitudinal prospective study from age three to age ten. *Journal of Social and Clinical Psychology, 29*(4), 462–488.

Dowlati, Y., Herrmann, N., Swardfager, W., Liu, H., Sham, L., Reim, E. K., & Lanctôt, K. L. (2010). A meta-analysis of cytokines in major depression. *Biological Psychiatry, 67*(5), 446–457.

Downey, G., & Coyne, J. C. (1990). Children of depressed parents: An integrative review. *Psychological Bulletin, 108*(1), 50–76.

Drury, S. S., Gleason, M. M., Theall, K. P., Smyke, A. T., Nelson, C. A., Fox, N. A., & Zeanah, C. H. (2012). Genetic sensitivity to the caregiving context: The influence of 5httlpr and BDNF val66met on indiscriminate social behavior. *Physiology & Behavior, 106*(5), 728–735.

Dube, S. R., Anda, R. F., Felitti, V. J., Chapman, D. P., Williamson, D. F., & Giles, W. H. (2001). Childhood abuse, household dysfunction, and the risk of attempted suicide throughout the life span: Findings from the Adverse Childhood Experiences Study. *JAMA, 286*(24), 3089–3096.

Dudley, K. J., Li, X., Kobor, M. S., Kippin, T. E., & Bredy, T. W. (2011). Epigenetic mechanisms mediating vulnerability and resilience to psychiatric disorders. *Neuroscience & Biobehavioral Reviews, 35*(7), 1544–1551.

Due, P., Damsgaard, M. T., Lund, R., & Holstein, B. E. (2009). Is bullying equally harmful for rich and poor children?: A study of bullying and depression from age 15 to 27. *European Journal of Public Health, 19*(5), 464–469.

Duncan, A. E., Munn-Chernoff, M. A., Hudson, D. L., Eschenbacher, M. A., Agrawal, A., Grant, J. D., … Bucholz, K. K. (2014). Genetic and environmental risk for major depression in African-American and European-American women. *Twin Research and Human Genetics, 17*(4), 244–253.

Duncan, G. J., Brooks-Gunn, J., & Klebanov, P. K. (1994). Economic deprivation and early childhood development. *Child Development, 65*(2), 296–318.

Duncan, L. E., & Keller, M. C. (2011). A critical review of the first 10 years of candidate gene-by-environment interaction research in psychiatry. *American Journal of Psychiatry, 168*(10), 1041–1049.

Duncan, L. E., Pollastri, A. R., & Smoller, J. W. (2014). Mind the gap: Why many geneticists and psychological scientists have discrepant views about gene–environment interaction (G× E) research. *American Psychologist, 69*(3), 249.

Dunn, E. C., Brown, R. C., Dai, Y., Rosand, J., Nugent, N. R., Amstadter, A. B., & Smoller, J. W. (2015). Genetic determinants of depression: Recent findings and future directions. *Harvard Review of Psychiatry, 23*(1), 1.

Eisenberg, N., Cumberland, A., & Spinrad, T. L. (1998). Parental socialization of emotion. *Psychological Inquiry, 9*(4), 241–273.

Eisenberg, N., Gershoff, E. T., Fabes, R. A., Shepard, S. A., Cumberland, A. J., Losoya, S. H., … Murphy, B. C. (2001). Mother's emotional expressivity and children's behavior problems and social competence: Mediation through children's regulation. *Developmental Psychology, 37*(4), 475–490.

Eisenberg, N., Valiente, C., Morris, A. S., Fabes, R. A., Cumberland, A., Reiser, M., … Losoya, S. (2003). Longitudinal relations among parental emotional expressivity, children's regulation, and quality of socioemotional functioning. *Developmental Psychology, 39*(1), 3–19.

Ellis, B. J., Bianchi, J. M., Griskevicius, V., & Frankenhuis, W. E. (2017). Beyond risk and protective factors: An adaptation-based approach to resilience. *Perspectives on Psychological Science, 12*(4), 561–587.

Ellis, B. J., Boyce, W. T., Belsky, J., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2011). Differential susceptibility to the environment: An evolutionary–neurodevelopmental theory. *Development and Psychopathology, 23*(1), 7–28.

Engel, G. L. (1977). The need for a new medical model: A challenge for biomedicine. *Science, 196*(4286), 129–136.

England, M. J., & Sim, L. J. (2009). *Depression in parents, parenting, and children: Opportunities to improve identification, treatment, and prevention*. Washington, DC: National Academies Press.

Erikson, E. H. (1993). *Childhood and society*. New York, NY: WW Norton & Company.

Evans, E., Hawton, K., & Rodham, K. (2004). Factors associated with suicidal phenomena in adolescents: A systematic review of population-based studies. *Clinical Psychology Review, 24*(8), 957–979.

Evans, G. W. (2004). The environment of childhood poverty. *American Psychologist, 59*(2), 77.

Everson, S. A., Maty, S. C., Lynch, J. W., & Kaplan, G. A. (2002). Epidemiologic evidence for the relation between socioeconomic status and depression, obesity, and diabetes. *Journal of Psychosomatic Research, 53*(4), 891–895.

Fearon, R. M., & Belsky, J. (2011). Infant–mother attachment and the growth of externalizing problems across the primary-school years. *Journal of Child Psychology and Psychiatry, 52*, 782–791.

Fearon, P., Groh, A. M., Bakermans-Kranenburg, M. J., Ijzendoorn, M. H., & Roisman, G. I. (2016). Attachment and developmental psychopathology. In D. Cicchetti (Ed.), Developmental psychopathology: Vol. 1. Theory and method (3rd ed., pp. 325– 384). New York: John Wiley & Sons.

Fenton, W. S., & Stover, E. S. (2006). Mood disorders: Cardiovascular and diabetes comorbidity. *Current Opinion in Psychiatry, 19*(4), 421–427.

Flint, J., & Kendler, K. S. (2014). The genetics of major depression. *Neuron, 81*(3), 484–503.

Foa, E. B., Stein, D. J., & McFarlane, A. C. (2006). Symptomatology and psychopathology of mental health problems after disaster. *Journal of Clinical Psychiatry, 67*(Suppl. 2), 15–25.

Foland-Ross, L. C., Behzadian, N., LeMoult, J., & Gotlib, I. H. (2016). Concordant patterns of brain structure in mothers with recurrent depression and their never-depressed daughters. *Developmental Neuroscience, 38*, 115–123.

Foti, D., & Hajcak, G. (2009). Depression and reduced sensitivity to non-rewards versus rewards: Evidence from event-related potentials. *Biological Psychology, 81*(1), 1–8.

Freud, A. (1966). *Normality and pathology in childhood* (p. 124). London, UK: Hogarth Press.

Freud, S. (1955). Fetishism. In J. Strachey (Ed.), *The standard edition of the complete psychological works of Sigmund Freud* (Vol. 21). London, UK: Hogarth. (Originally published, 1927).

Fuller, B., & García Coll, C. (2010). Learning from Latinos: Contexts, families, and child development in motion. *Developmental Psychology, 46*(3), 559.

Garber, J. (1984). Classification of childhood psychopathology: A developmental perspective. *Child Development, 55*(1), 30–48.

Garber, J. (2000). Development and depression. In A. Sameroff, M. Lewis, & S. M. Miller (Eds.), *Handbook of developmental psychopathology*

(pp. 466–490). New York, NY: Springer Science and Business Media Inc..

Garber, J., Braafladt, N., & Weiss, B. (1995). Affect regulation in depressed and nondepressed children and young adolescents. *Development & Psychopathology. Special Issue: Emotions in developmental psychopathology, 7*(1), 93–115.

Garber, J., Braafladt, N., & Zeman, J. (1991). The regulation of sad affect: An information-processing perspective. In J. Garber & K. A. Dodge (Eds.), *The development of emotion regulation and dysregulation. Cambridge Studies in Social and Emotional Development* (pp. 208–240). New York, NY: Cambridge University Press.

Garber, J., Clarke, G. N., Weersing, V. R., Beardslee, W. R., Brent, D. A., Gladstone, T. R. G., … Iyengar, S. (2009). Prevention of depression in at-risk adolescents: A randomized controlled trial. *Journal of the American Medical Association, 301*(21), 2215–2224.

Garcia Coll, C., Crnic, K., Lamberty, G., Wasik, B. H., Jenkins, R., García, H. V., & McAdoo, H. P. (1996). An integrative model for the study of developmental competencies in minority children. *Child Development, 67*, 1891–1914.

Gershon, A., Hayward, R. C., Schraedley-Desmond, P., Rudolph, K. D., Booster, G. D., & Gotlib, I. H. (2011). Life stress and first onset of psychiatric disorders in daughters of depressed mothers. *Journal of Psychiatric Research, 45*, 855–862.

Gilbert, P. (2017). *Depression: The evolution of powerlessness*. New York, NY: Routledge.

Gilman, S. E., Kawachi, I., Fitzmaurice, G. M., & Buka, S. L. (2002). Socioeconomic status in childhood and the lifetime risk of major depression. *International Journal of Epidemiology, 31*(2), 359–367.

Gladstone, T. R. G., & Beardslee, W. R. (2009). The prevention of depression in children and adolescents: A review. *The Canadian Journal of Psychiatry, 54*(4), 212–221.

Gold, P. W. (2015). The organization of the stress system and its dysregulation in depressive illness. *Molecular Psychiatry, 20*(1), 32–47.

Goldstein, K. (1940). *Human nature in the light of psychopathology*. Cambridge, MA: Oxford University Press.

Goldston, D. B., Daniel, S. S., Erkanli, A., Reboussin, B. A., Mayfield, A., Frazier, P. H., & Treadway, S. L. (2009). Psychiatric diagnoses as contemporaneous risk factors for suicide attempts among adolescents and young adults: Developmental changes. *Journal of Consulting and Clinical Psychology, 77*(2), 281.

Goodman, S. H., & Gotlib, I. H. (1999). Risk for psychopathology in the children of depressed mothers: A developmental model for understanding mechanisms of transmission. *Psychological Review, 106*(3), 458–490.

Goodman, S. H., Rouse, M. H., Connell, A. M., Broth, M. R., Hall, C. M., & Heyward, D. (2011). Maternal depression and child psychopathology: A meta-analytic review. *Clinical Child and Family Psychology Review, 14*, 1–27.

Gotlib, I. H., & Avison, W. R. (1993). Children at risk for psychopathology. In C. G. Costello (Ed.), *Basic issues in psychopathology* (pp. 271–319). New York, NY: Guilford Press.

Gottman, J. M., Katz, L. F., & Hooven, C. (1997). *Meta-emotion*. Mahwah, NJ: Lawrence Erlbaum.

Greenberg, M. T., & Harris, A. R. (2012). Nurturing mindfulness in children and youth: Current state of research. *Child Development Perspectives, 6*(2), 161–166.

Groh, A. M., Roisman, G. I., van Ijzendoorn, M. H., Bakermans-Kranenburg, M. J., & Fearon, R. P. (2012). The significance of insecure and disorganized attachment for children's internalizing symptoms: A meta-analytic study. *Child Development, 83*(2), 591–610.

Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2*(3), 271.

Gunn, J. F., III, & Goldstein, S. E. (2017). Bullying and suicidal behavior during adolescence: A developmental perspective. *Adolescent Research Review, 2*(2), 77–97.

Gunnar, M., & Quevedo, K. (2007). The neurobiology of stress and development. *Annual Review of Psychology, 58*, 145–173.

Gunnar, M. R., & Cicchetti, D. (2009). Meeting the challenge of translational research in child development. In M. R. Gunnar & D. Cicchetti (Eds.), *Minnesota symposia on child psychology* (Vol. 35, pp. 1–27). New York, NY: Wiley.

Gunnar, M. R., Doom, J. R., & Esposito, E. A. (2015). Psychoneuroendocrinology of stress: Normative development and individual differences. In *Handbook of child psychology and developmental science, vol. 3: Socioemotional processes* (7th ed., pp. 106–151).

Gunnar, M. R., Sebanc, A. M., Donzella, B., & Van Dulmen, M. M. H. (2003). Peer rejection, temperament, and cortisol activity in preschoolers. *Developmental Psychobiology, 43*, 346–358.

Guyer, A. E., Silk, J. S., & Nelson, E. E. (2016). The neurobiology of the emotional adolescent: From the inside out. *Neuroscience and Biobehavioral Reviews, 70*, 74–85.

Hallgren, M., Herring, M. P., Owen, N., Dunstan, D., Ekblom, Ö., Helgadottir, B., … Forsell, Y. (2016). Exercise, physical activity, and sedentary behavior in the treatment of depression: Broadening the scientific perspectives and clinical opportunities. *Frontiers in Psychiatry, 7*, 36.

Halligan, S. L., Herbert, J., Goodyer, I. M., & Murray, L. (2004). Exposure to post-natal depression predicts elevated cortisol in adolescent offspring. *Biological Psychiatry, 55*(4), 376–381.

Hammad, T. A., Laughren, T., & Racoosin, J. (2006). Suicidality in pediatric patients treated with antidepressant drugs. *Archives of General Psychiatry, 63*(3), 332–339.

Hammen, C. (1991). *Depression runs in families: The social context of risk and resilience in children of depressed mothers*. New York, NY: Springer-Verlag.

Hammen, C. (2005). Stress and depression. *Annual Review of Clinical Psychology, 1*, 293–319.

Hammen, C., & Brennan, P. (2003). Severity, chronicity, and timing of maternal depression and risk for adolescent offspring diagnoses in a community sample. *Archives of General Psychiatry, 60*, 253–258.

Hammen, C., Burge, D., & Adrian, C. (1991). Timing of mother and child depression in a longitudinal study of children at risk. *Journal of Consulting and Clinical Psychology, 59*(2), 341–345.

Hammen, C., Burge, D., Hamilton, E. B., & Adrian, C. (1990). Longitudinal study of diagnoses in children of women with unipolar and bipolar affective disorder. *Archives of General Psychiatry, 47*(12), 1112.

Hankin, B. L. (2017). Depression during childhood and adolescence. In *The Oxford Handbook of Mood Disorders* (Vol. 276). New York, NY: Oxford University Press.

Hankin, B. L., Mermelstein, R., & Roesch, L. (2007). Sex differences in adolescent depression: Stress exposure and reactivity models. *Child Development, 78*(1), 279–295.

Hankin, B. L., Snyder, H. R., & Gulley, L. D. (2013). Cognitive risks in developmental psychopathology. *Development and Psychopathology, 3*, 8 1–74.

Harkness, K. L., Monroe, S. M., Simons, A. D., & Thase, M. (1999). The generation of life events in recurrent and non-recurrent depression. *Psychological Medicine, 29*(1), 135–144.

Hasin, D. S., Goodwin, R. D., Stinson, F. S., & Grant, B. F. (2005). Epidemiology of major depressive disorder: Results from the National Epidemiologic Survey on alcoholism and related conditions. *Archives of General Psychiatry, 62*(10), 1097–1106.

Heim, C., & Binder, E. B. (2012). Current research trends in early life stress and depression: Review of human studies on sensitive periods, gene–environment interactions, and epigenetics. *Experimental Neurology, 233*(1), 102–111.

Heim, C., Newport, D. J., Mletzko, T., Miller, A. H., & Nemeroff, C. B. (2008). The link between childhood trauma and depression: Insights from HPA axis studies in humans. *Psychoneuroendocrinology, 33*(6), 693–710.

Hinshaw, S. P., & Cicchetti, D. (2000). Stigma and mental disorder: Conceptions of illness, public attitudes, personal disclosure, and social policy. *Development and Psychopathology, 12*(4), 555–598.

Ho, T. C., Sanders, S. J., Gotlib, I. H., & Hoeft, F. (2016). Intergenerational neuroimaging of human brain circuitry. *Trends in Neurosciences, 39*(10), 644–648.

Hodes, G. E., Kana, V., Menard, C., Merad, M., & Russo, S. J. (2015). Neuroimmune mechanisms of depression. *Nature Neuroscience, 18*(10), 1386–1393.

Holroyd, C. B., & Coles, M. G. (2002). The neural basis of human error processing: Reinforcement learning, dopamine, and the error-related negativity. *Psychological Review, 109*(4), 679–709.

Hostinar, C. E., & Gunnar, M. R. (2013). Future directions in the study of social relationships as regulators of the HPA axis across development. *Journal of Clinical Child & Adolescent Psychology, 42*(4), 564–575.

Hostinar, C. E., Johnson, A. E., & Gunnar, M. R. (2014). Parent support is less effective in buffering cortisol stress reactivity for adolescents compared to children. *Developmental Science, 18*(2), 281–297.

Insel, T., Cuthbert, B., Garvey, M., Heinssen, R., Pine, D. S., Quinn, K., … Wang, P. (2010). Research Domain Criteria (RDoC): Toward a new classification framework for research on mental disorders. *American Journal of Psychiatry, 167*(7), 748–751.

Insel, T. R. (2009a). Disruptive insights in psychiatry: Transforming a clinical discipline. *Journal of Clinical Investigation, 119*(4), 700–705.

Insel, T. R. (2009b). Translating scientific opportunity into public health impact. *JAMA Psychiatry, 66*(2), 128–133.

Jackson, S. W. (1986). *Melancholia and depression: From hippocratic times to modern times*. New Haven, CT: Yale University Press.

Jackson, Y., & Warren, J. S. (2000). Appraisal, social support, and life events: Predicting outcome behavior in school-age children. *Child Development, 71*, 1441–1457.

Janson, H., & Mathiesen, K. S. (2008). Temperament profiles from infancy to middle childhood: Development and associations with behavior problems. *Developmental Psychology, 44*(5), 1314.

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice, 10*(2), 144–156.

Kagan, J., Snidman, N., McManis, M., Woodward, S., & Hardway, C. (2002). One measure, one meaning: Multiple measures, clearer meaning. *Development and Psychopathology, 14*(3), 463–475.

Kaplow, J. B., & Widom, C. S. (2007). Age of onset of child maltreatment predicts long-term mental health outcomes. *Journal of Abnormal Psychology, 116*(1), 176.

Karg, K., Burmeister, M., Shedden, K., & Sen, S. (2011). The serotonin transporter promoter variant (5-HTTLPR), stress, and depression meta-analysis revisited: Evidence of genetic moderation. *Archives of General Psychiatry, 68*(5), 444–454.

Kashani, J. H., Husain, A., Shekim, W. O., Hodges, K. K., Cytryn, L., & McKnew, D. H. (1981). Current perspectives on childhood depression: An overview. *American Journal of Psychiatry, 138*(2), 143–153.

Kashima, Y. (2000). Conceptions of culture and person for psychology. *Journal of Cross-Cultural Psychology, 31*(1), 14–32.

Kaslow, N. J., Brown, R. T., & Mee, L. L. (1994). Cognitive and behavioral correlates of childhood depression. In *Handbook of depression in children and adolescents* (pp. 97–121). Boston, MA: Springer.

Kegel, C. A., Bus, A. G., & van IJzendoorn, M. H. (2011). Differential susceptibility in early literacy instruction

through computer games: The role of the dopamine D4 receptor gene (DRD4). *Mind, Brain, and Education, 5*(2), 71–78.

Keller, M. C. (2014). Gene× environment interaction studies have not properly controlled for potential confounders: The problem and the (simple) solution. *Biological Psychiatry, 75*(1), 18–24.

Kendler, K. S., Gardner, C. O., Neale, M. C., & Prescott, C. A. (2001). Genetic risk factors for major depression in men and women: Similar or different heritabilities and same or partly distinct genes? *Psychological Medicine: Journal of Research in Psychiatry and the Allied Sciences, 31*(4), 605–616.

Kendler, K. S., Gatz, M., Gardner, C. O., & Pedersen, N. L. (2006). A Swedish national twin study of lifetime major depression. *American Journal of Psychiatry, 163*(1), 109–114.

Kerestes, R., Davey, C. G., Stephanou, K., Whittle, S., & Harrison, B. J. (2014). Functional brain imaging studies of youth depression: A systematic review. *NeuroImage: Clinical, 4*, 209–231.

Kessler, R. C. (1997). The effects of stressful life events on depression. *Annual Review of Psychology, 48*(1), 191–214.

Kessler, R. C., & Magee, W. J. (1993). Childhood adversities and adult depression: Basic patterns of association in a US national survey. *Psychological Medicine, 23*, 679–690.

Kessler, R. C., McLaughlin, K. A., Green, J. G., Gruber, M. J., Sampson, N. A., Zaslavsky, A. M., … Benjet, C. (2010). Childhood adversities and adult psychopathology in the WHO World Mental Health Surveys. *The British Journal of Psychiatry, 197*(5), 378–385.

Kessler, R. C., Petukhova, M., Sampson, N. A., Zaslavsky, A. M., & Wittchen, H. U. (2012). Twelve-month and lifetime prevalence and lifetime morbid risk of anxiety and mood disorders in the United States. *International Journal of Methods in Psychiatric Research, 21*(3), 169–184.

Kessler, R. C., & Wang, P. S. (2009). Epidemiology of depression. In I. Gotlib & C. Hammen (Eds.), *Handbook of depression* (pp. 23–44). New York, NY: Guilford Press.

Khantzian, E. J. (1997). The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. *Harvard Review of Psychiatry, 4*(5), 231–244.

Kim-Cohen, J., Caspi, A., Moffitt, T. E., Harrington, H., Milne, B. J., & Poulton, R. (2003). Prior juvenile diagnoses in adults with mental disorder: Developmental follow-back of a prospective-longitudinal cohort. *Archives of General Psychiatry, 60*(7), 709–717.

King, L. S., Colich, N. L., LeMoult, J., Humphreys, K. L., Ordaz, S. J., Price, A. N., & Gotlib, I. H. (2017). The impact of the severity of early life stress on diurnal cortisol: The role of puberty. *Psychoneuroendocrinology, 77*, 68–74.

Kitayama, S., & Uskul, A. K. (2011). Culture, mind, and the brain: Current evidence and future directions. *Annual Review of Psychology, 62*, 419–449.

Klein, J. B., & Jacobs, R. H. (2007). Cognitive-behavioral therapy for adolescent depression: A meta-analytic investigation of changes in effect-size estimates. *Journal of the American Academy of Child & Adolescent Psychiatry, 46*(11), 1403–1413.

Klimstra, T. A., Akse, J., Hale, W. W., III, Raaijmakers, Q. A., & Meeus, W. H. (2010). Longitudinal associations between personality traits and problem behavior symptoms in adolescence. *Journal of Research in Personality, 44*(2), 273–284.

Klomek, A. B., Marrocco, F., Kleinman, M., Schonfeld, I. S., & Gould, M. S. (2008). Peer victimization, depression, and suicidiality in adolescents. *Suicide and Life-threatening Behavior, 38*(2), 166–180.

Kodl, M. M., Fu, S. S., Willenbring, M. L., Gravely, A., Nelson, D. B., & Joseph, A. M. (2008). The impact of depressive symptoms on alcohol and cigarette consumption following treatment for alcohol and nicotine dependence. *Alcoholism: Clinical and Experimental Research, 32*(1), 92–99.

Kroeber, A. L., & Kluckhohn, C. (1952). Culture: A critical review of concepts and definitions. *Papers of the Peabody Museum of Archaeology and Ethnology, 47*(1), 3–217.

Laceulle, O. M., Ormel, J., Aggen, S. H., Neale, M. C., & Kendler, K. S. (2013). Genetic and environmental influences on the longitudinal structure of neuroticism: A trait-state approach. *Psychological Science, 24*(9), 1780–1790.

Laceulle, O. M., Ormel, J., Vollebergh, W. A., Aken, M. A., & Nederhof, E. (2013). A test of the vulnerability model: Temperament and temperament change as predictors of future mental disorders–the TRAILS study. *Journal of Child Psychology and Psychiatry, 55*(3), 227–236.

Latkin, C. A., & Curry, A. D. (2003). Stressful neighborhoods and depression: A prospective study of the impact of neighborhood disorder. *Journal of Health and Social Behavior, 44*, 34–44.

Laye-Gindhu, A., & Schonert-Reichl, K. A. (2005). Nonsuicidal self-harm among community adolescents: Understanding the "whats" and "whys" of self-harm. *Journal of Youth and Adolescence, 34*(5), 447–457.

Lefèvre, T., Singh-Manoux, A., Stringhini, S., Dugravot, A., Lemogne, C., Consoli, S. M., … Nabi, H. (2011). Usefulness of a single-item measure of depression to predict mortality: The GAZEL prospective cohort study. *The European Journal of Public Health, 22*(5), 643–647.

LeMoult, J., Chen, M. C., Foland-Ross, L. C., Burley, H. W., & Gotlib, I. H. (2015). Concordance of mother-daughter diurnal cortisol production: Understanding the intergenerational transmission of risk for depression. *Biological Psychology, 108*, 98–104.

Lengua, L. J., West, S. G., & Sandler, I. N. (1998). Temperament as a predictor of symptomatology in children: Addressing contamination of measures. *Child Development, 69*(1), 164–181.

Leslie, L. K., Newman, T. B., Chesney, P. J., & Perrin, J. M. (2005). The Food and Drug Administration's

deliberations on antidepressant use in pediatric patients. *Pediatrics, 116*(1), 195–204.

Lutkenhaus, P., Grossmann, K. E., & Grossmann, K. (1985). Infant-mother attachment at 12 months and style of interaction with a stranger at the age of three years. *Child Development, 56*, 1538–1572.

Lyons, D. M., & Parker, K. J. (2007). Stress inoculation-induced indications of resilience in monkeys. *Journal of Traumatic Stress, 20*(4), 423–433.

Madigan, S., Atkinson, L., Laurin, K., & Benoit, D. (2013). Attachment and internalizing behavior in early childhood: A meta-analysis. *Developmental Psychology, 49*(4), 672–689.

Main, M., & Solomon, J. (1986). Discovery of a new, insecure–disorganized/ disoriented attachment pattern. In T. B. Brazelton & M. V. Yogman (Eds.), *Affective development in infancy* (pp. 95–124). Norwood, OH: Ablex.

Malouff, J. M., Thorsteinsson, E. B., & Schutte, N. S. (2005). The relationship between the five-factor model of personality and symptoms of clinical disorders: A meta-analysis. *Journal of Psychopathology and Behavioral Assessment, 27*(2), 101–114.

Mansell, T., Vuillermin, P., Ponsonby, A. L., Collier, F., Saffery, R., & Ryan, J. (2016). Maternal mental well-being during pregnancy and glucocorticoid receptor gene promoter methylation in the neonate. *Development and Psychopathology, 28*(4pt2), 1421–1430.

Masten, A. S. (1986). Humor and competence in school-aged children. *Child Development, 57*(2), 461–473.

Masten, A. S., & Cicchetti, D. (2016). Resilience in development: Progress and transformation. *Development and Psychopathology, 4*(6), 1–63.

Masten, A. S., & Garmezy, N. (1985). Risk, vulnerability, and protective factors in developmental psychopathology. In B. B. Lashey & A. E. Kazdin (Eds.), *Advances in clinical child psychology* (pp. 1–52). Boston, MA: Springer.

Maughan, A., & Cicchetti, D. (2002). Impact of child maltreatment and interadult violence on children's emotion regulation abilities and socioemotional adjustment. *Child Development, 73*(5), 1525–1542.

McCauley, J., Kern, D. E., Kolodner, K., Dill, L., Schroeder, A. F., DeChant, H. K., … Bass, E. B. (1997). Clinical characteristics of women with a history of childhood abuse: Unhealed wounds. *JAMA, 277*(17), 1362–1368.

McCrae, R. R., Costa, P. T., Jr., Ostendorf, F., Angleitner, A., Hřebíčková, M., Avia, M. D., … Saunders, P. R. (2000). Nature over nurture: Temperament, personality, and life span development. *Journal of Personality and Social Psychology, 78*(1), 173.

McLaughlin, K. A., Hatzenbuehler, M. L., & Hilt, L. M. (2009). Emotion dysregulation as a mechanism linking peer victimization to internalizing symptoms in adolescents. *Journal of Consulting and Clinical Psychology, 77*(5), 894–904.

McLaughlin, K. A., & Nolen-Hoeksema, S. (2011). Rumination as a transdiagnostic factor in depression and anxiety. *Behaviour Research and Therapy, 49*(3), 186–193.

McMahon, S. D., Grant, K. E., Compas, B. E., Thurm, A. E., & Ey, S. (2003). Stress and psychopathology in children and adolescents: Is there evidence of specificity? *Journal of Child Psychology and Psychiatry, 44*(1), 107–133.

Mendle, J., Harden, K. P., Brooks-Gunn, J., & Garber, J. A. (2010). Development's tortoise and hare: Pubertal timing, pubertal tempo, and depressive symptoms in boys and girls. *Developmental Psychology, 46*(5), 1341.

Merikangas, K. R., He, J. P., Burstein, M., Swanson, S. A., Avenevoli, S., Cui, L., … Swendsen, J. (2010). Lifetime prevalence of mental disorders in US adolescents: Results from the National Comorbidity Survey Replication–Adolescent Supplement (NCS-A). *Journal of the American Academy of Child & Adolescent Psychiatry, 49*(10), 980–989.

Merikangas, K. R., Leckman, J. F., Prusoff, B. A., Pauls, D. L., & Weissman, M. M. (1985). Familial transmission of depression and alcoholism. *Archives of General Psychiatry, 42*(4), 367–372.

Mersky, J. P., Topitzes, J., & Reynolds, A. J. (2013). Impacts of adverse childhood experiences on health, mental health, and substance use in early adulthood: A cohort study of an urban, minority sample in the US. *Child Abuse & Neglect, 37*(11), 917–925.

Mervielde, I., De Clercq, B., De Fruyt, F., & Van Leeuwen, K. (2005). Temperament, personality, and developmental psychopathology as childhood antecedents of personality disorders. *Journal of Personality Disorders, 19*(2), 171–201.

Miller, C. H., Hamilton, J. P., Sacchet, M. D., & Gotlib, I. H. (2015). Meta-analysis of functional neuroimaging of major depressive disorder in youth. *JAMA Psychiatry, 72*(10), 1045–1053.

Miller, G. E., & Cole, S. W. (2012). Clustering of depression and inflammation in adolescents previously exposed to childhood adversity. *Biological Psychiatry, 72*(1), 34–40.

Moffitt, T. E., Caspi, A., Harrington, H., Milne, B. J., Melchior, M., Goldberg, D., & Poulton, R. (2007). Generalized anxiety disorder and depression: Childhood risk factors in a birth cohort followed to age 32. *Psychological Medicine, 37*(3), 441–452.

Moffitt, T. E., & The Klaus-Graw 2012 Think Tank. (2013). Childhood exposure to violence and lifelong health: Clinical intervention science and stress-biology research join forces. *Development and Psychopathology, 25*(2013), 1619–1634.

Morris, A. S., Silk, J. S., Steinberg, L., Myers, S. S., & Robinson, L. R. (2007). The role of the family context in the development of emotion regulation. *Social Development, 16*(2), 361–388.

Mrazek, D. A., Hornberger, J. C., Altar, C. A., & Degtiar, I. (2014). A review of the clinical, economic, and societal burden of treatment-resistant depression: 1996–2013. *Psychiatric Services, 65*(8), 977–987.

Mrazek, P., & Haggerty, R. (Eds.). (1994). *Reducing risks for mental disorders: Frontiers for preventive intervention research*. Washington, DC: National Academy Press.

Murali, V., & Oyebode, F. (2004). Poverty, social inequality and mental health. *Advances in Psychiatric Treatment, 10*(3), 216–224.

Nelson, E. E., Leibenluft, E., McClure, E. B., & Pine, D. S. (2005). The social re-orientation of adolescence: A neuroscience perspective on the process and its relation to psychopathology. *Psychological Medicine, 35*, 163–174.

Ng, M. Y., & Weisz, J. R. (2016). Annual research review: Building a science of personalized intervention for youth mental health. *Journal of Child Psychology and Psychiatry, 57*(3), 216–236.

Nigg, J. T. (2006). Temperament and developmental psychopathology. *Journal of Child Psychology and Psychiatry, 47*(3-4), 395–422.

Nixon, M. K., Cloutier, P. F., & Aggarwal, S. (2002). Affect regulation and addictive aspects of repetitive self-injury in hospitalized adolescents. *Journal of the American Academy of Child & Adolescent Psychiatry, 41*(11), 1333–1341.

Nusslock, R., & Miller, G. E. (2016). Early-life adversity and physical and emotional health across the lifespan: A neuroimmune network hypothesis. *Biological Psychiatry, 80*(1), 23–32.

Ochsner, K. N., & Gross, J. J. (2007). The neural architecture of emotion regulation. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 87–109). New York, NY: Guilford Press.

Olweus, D. (1997). Bully/victim problems in school: Facts and intervention. *European Journal of Psychology of Education, XII*(4), 495–510.

Ormel, J., Jeronimus, B. F., Kotov, R., Riese, H., Bos, E. H., Hankin, B., … Oldehinkel, A. J. (2013). Neuroticism and common mental disorders: Meaning and utility of a complex relationship. *Clinical Psychology Review, 33*(5), 686–697.

Østergaard, S. D., Jensen, S. O. W., & Bech, P. (2011). The heterogeneity of the depressive syndrome: When numbers get serious. *Acta Psychiatrica Scandinavica, 124*(6), 495–496.

Osuch, E. A., Noll, J. G., & Putnam, F. W. (1999). The motivations for self-injury in psychiatric inpatients. *Psychiatry, 62*(4), 334–346.

Palma-Gudiel, H., Córdova-Palomera, A., Leza, J. C., & Fañanás, L. (2015). Glucocorticoid receptor gene (NR3C1) methylation processes as mediators of early adversity in stress-related disorders causality: A critical review. *Neuroscience & Biobehavioral Reviews, 55*, 520–535.

Papp, L. M., Pendry, P., & Adam, E. K. (2009). Mother-adolescent physiological synchrony in naturalistic settings: Within-family cortisol associations and moderators. *Journal of Family Psychology, 23*(6), 882–894.

Patton, G. C., Coffey, C., Posterino, M., Carlin, J. B., & Bowes, G. (2003). Life events and early onset depression: Cause or consequence? *Psychological Medicine, 33*(7), 1203–1210.

Pedrelli, P., Shapero, B., Archibald, A., & Dale, C. (2016). Alcohol use and depression during adolescence and young adulthood: A summary and interpretation of mixed findings. *Current Addiction Reports, 3*(1), 91–97.

Petersen, A. C., Compas, B. E., Brooks-Gunn, J., Stemmler, M., Ey, S., & Grant, K. E. (1993). Depression in adolescence. *American Psychologist, 48*(2), 155–168.

Phillips, M. L., Drevets, W. C., Rauch, S. L., & Lane, R. (2003). Neurobiology of emotion perception I: The neural basis of normal emotion perception. *Biological Psychiatry, 54*(5), 504–514.

Phillips, M. L., Ladouceur, C. D., & Drevets, W. C. (2008). A neural model of voluntary and automatic emotion regulation: Implications for understanding the pathophysiology and neurodevelopment of bipolar disorder. *Molecular Psychiatry, 13*(9), 833–857.

Piacentini, J., & Pataki, C. (2016). Substance abuse in depressed adolescents. *Depression in Children and Adolescents, 4*, 133.

Pickreign Stronach, E., Toth, S., Rogosch, F., & Cicchetti, D. (2013). Preventive interventions and sustained attachment security in maltreated children. *Development and Psychopathology, 25*(4pt1), 919–930.

Plener, P. L., Kapusta, N. D., Brunner, R., & Kaess, M. (2014). Non-suicidal self-injury (NSSI) and suicidal behavior disorder in the DSM-5. *Zeitschrift fur Kinder-und Jugendpsychiatrie und Psychotherapie, 42*(6), 405–411.

Plener, P. L., Schumacher, T. S., Munz, L. M., & Groschwitz, R. C. (2015). The longitudinal course of non-suicidal self-injury and deliberate self-harm: A systematic review of the literature. *Borderline Personality Disorder and Emotion Dysregulation, 2*(1), 2.

Pons, F., Lawson, J., Harris, P. L., & De Rosnay, M. (2003). Individual differences in children's emotion understanding: Effects of age and language. *Scandinavian Journal of Psychology, 44*(4), 347–353.

Post, R. M. (1992). Transduction of psychosocial stress into the neurobiology of recurrent affective disorder. *The American Journal of Psychiatry, 149*(8), 999.

Power, R. A., Keers, R., Ng, M. Y., Butler, A. W., Uher, R., Cohen-Woods, S., … Jones, L. (2012). Dissecting the genetic heterogeneity of depression through age at onset. *American Journal of Medical Genetics Part B: Neuropsychiatric Genetics, 159*(7), 859–868.

Rasic, D., Hajek, T., Alda, M., & Uher, R. (2013). Risk of mental illness in offspring of parents with schizophrenia, bipolar disorder, and major depressive disorder: A meta-analysis of family high-risk studies. *Schizophrenia Bulletin, 40*(1), 28–38.

Repetto, P. B., Zimmerman, M. A., & Caldwell, C. H. (2004). A longitudinal study of the relationship between depressive symptoms and alcohol use in a sample of inner-city Black youth. *Journal of Studies on Alcohol, 65*(2), 169–178.

Rice, F., Harold, G., & Thapar, A. (2002). The genetic aetiology of childhood depression: A review. *Journal of Child Psychology and Psychiatry, 43*(1), 65–79.

Rie, H. E. (1966). Depression in childhood: A survey of some pertinent contributions. *Journal of the American Academy of Child Psychiatry, 5*(4), 653–685.

Rieder, C., & Cicchetti, D. (1989). Organizational perspective on cognitive control functioning and cognitive-affective balance in maltreated children. *Developmental Psychology, 25*(3), 382–393.

Rigby, K. (2000). Effects of peer victimization in schools and perceived social support on adolescent well-being. *Journal of Adolescence, 23*(1), 57–68.

Rigby, K., & Slee, P. T. (1999). Suicidal ideation among adolescent school children, involvement in bullying-victim problems, and perceived social support. *Suicide and Life-threatening Behavior, 29*(2), 119–130.

Ripke, S., Wray, N. R., Lewis, C. M., Hamilton, S. P., Weissman, M. M., Breen, G., … Cichon, S. (2013). Major Depressive Disorder Working Group of the Psychiatric GWAS consortium A mega-analysis of genome-wide association studies for major depressive disorder. *Molecular Psychiatry, 18*(4), 497–511.

Risch, N., Herrell, R., Lehner, T., Liang, K. Y., Eaves, L., Hoh, J., … Merikangas, K. R. (2009). Interaction between the serotonin transporter gene (5-HTTLPR), stressful life events, and risk of depression: A meta-analysis. *JAMA, 301*(23), 2462–2471.

Rive, M. M., van Rooijen, G., Veltman, D. J., Phillips, M. L., Schene, A. H., & Ruhé, H. G. (2013). Neural correlates of dysfunctional emotion regulation in major depressive disorder. A systematic review of neuroimaging studies. *Neuroscience & Biobehavioral Reviews, 37*(10), 2529–2553.

Rodham, K., Hawton, K., & Evans, E. (2004). Reasons for deliberate self-harm: Comparison of self-poisoners and self-cutters in a community sample of adolescents. *Journal of the American Academy of Child & Adolescent Psychiatry, 43*(1), 80–87.

Rosenström, T., Jylhä, P., Cloninger, C. R., Hintsanen, M., Elovainio, M., Mantere, O., … Isometsä, E. (2014). Temperament and character traits predict future burden of depression. *Journal of Affective Disorders, 158*, 139–147.

Rosenström, T., Jylhä, P., Pulkki-Råback, L., Holma, M., Raitakari, O. T., Isometsä, E., & Keltikangas-Järvinen, L. (2015). Long-term personality changes and predictive adaptive responses after depressive episodes. *Evolution and Human Behavior, 36*(5), 337–344.

Ross, S., & Heath, N. (2003). Two models of adolescent self-mutilation. *Suicide and Life-threatening Behavior, 33*(3), 277–287.

Rudolph, K. D., Hammen, C., Burge, D., Lindberg, N., Herzberg, D., & Daley, S. E. (2000). Toward an interpersonal life-stress model of depression: The developmental context of stress generation. *Development and Psychopathology, 12*(2), 215–234.

Rueger, S. Y., Malecki, C. K., Pyun, Y., Aycock, C., & Coyle, S. (2016). A meta-analytic review of the association between perceived social support and depression in childhood and adolescence. *Psychological Bulletin, 142*(10), 1017–1067.

Sameroff, A. J., & Seifer, R. (1983). Familial risk and child competence. *Child Development, 54*(5), 1254–1268.

Schwartz, O. S., Simmons, J. G., Whittle, S., Byrne, M. L., Yap, M. B., Sheeber, L. B., & Allen, N. B. (2017). Affective parenting behaviors, adolescent depression, and brain development: A review of findings from the Orygen Adolescent Development Study. *Child Development Perspectives, 11*(2), 90–96.

Scott, K. M., Von Korff, M., Alonso, J., Angermeyer, M. C., Bromet, E., Fayyad, J., … Haro, J. M. (2009). Mental–physical co-morbidity and its relationship with disability: Results from the World Mental Health Surveys. *Psychological Medicine, 39*(1), 33–43.

Scourfield, J., Rice, F., Thapar, A., Harold, G. T., Martin, N., & McGuffin, P. (2003). Depressive symptoms in children and adolescents: Changing aetiological influences with development. *Journal of Child Psychology and Psychiatry, 44*(7), 968–976.

Seals, D., & Young, J. (2003). Bullying and victimization: Prevalence and relationship to gender, grade level, ethnicity, self-esteem, and depression. *Adolescence, 38*(152), 735.

Selby, E. A., Bender, T. W., Gordon, K. H., Nock, M. K., & Joiner, T. E., Jr. (2012). Non-suicidal self-injury (NSSI) disorder: A preliminary study. *Personality Disorders: Theory, Research, and Treatment, 3*(2), 167.

Seligman, M. E. (1975). *Helplessness: On depression, development, and health*. San Francisco, CA: Freeman.

Shankman, S. A., Klein, D. N., Tenke, C. E., & Bruder, G. E. (2007). Reward sensitivity in depression: A biobehavioral study. *Journal of Abnormal Psychology, 116*(1), 95–104.

Shannon, K. E., Beauchaine, T. P., Brenner, S. L., Neuhaus, E., & Gatzke-Kopp, L. (2007). Familial and temperamental predictors of resilience in children at risk for conduct disorder and depression. *Development and Psychopathology, 19*(3), 701–727.

Shepperd, C., & McAllister, M. (2003). CARE: A framework for responding therapeutically to the client who self-harms. *Journal of Psychiatric and Mental Health Nursing, 10*(4), 442–447.

Sherman, B. J., Vousoura, E., Wickramaratne, P., Warner, V., & Verdeli, H. (2016). Temperament and major depression: How does difficult temperament affect frequency, severity, and duration of major depressive episodes among offspring of parents with or without depression? *Journal of Affective Disorders, 200*, 82–88.

Shiner, R. L., Buss, K. A., McClowry, S. G., Putnam, S. P., Saudino, K. J., & Zentner, M. (2012). What is temperament now? Assessing progress in temperament research on the twenty-fifth anniversary of Goldsmith et al.(). *Child Development Perspectives, 6*(4), 436–444.

Shiner, R. L., Masten, A. S., & Tellegen, A. (2002). A developmental perspective on personality in emerging adulthood: Childhood antecedents and concur-

rent adaptation. *Journal of Personality and Social Psychology, 83*(5), 1165–1177.
Shipman, K., & Zeman, J. (2001). Socialization of children's emotion regulation in mother–child dyads: A developmental psychopathology perspective. *Development and Psychopathology, 13*(2), 317–336.
Silk, J. S., Steinberg, L., & Morris, A. S. (2003). Adolescents' emotion regulation in daily life: Links to depressive symptoms and problem behavior. *Child Development, 74*(6), 1869–1880.
Slavich, G. M., Monroe, S. M., & Gotlib, I. H. (2011). Early parental loss and depression history: Associations with recent life stress in major depressive disorder. *Journal of Psychiatric Research, 45*(9), 1146–1152.
Slee, P. T. (1995). Bullying: Health concerns of Australian secondary school students. *International Journal of Adolescence and Youth, 5*, 215–224.
Southwick, S. M., Vythilingam, M., & Charney, D. S. (2005). The psychobiology of depression and resilience to stress: Implications for prevention and treatment. *Annual Review of Clinical Psychology, 1*, 255–291.
Sroufe, L. A. (1979). The coherence of individual development: Early care, attachment, and subsequent developmental issues. *American Psychologist, 34*(10), 834.
Sroufe, L. A., & Rutter, M. (1984). The domain of developmental psychopathology. *Child Development, 55*(1), 17–29.
Stalets, M. M., & Luby, J. L. (2006). Preschool depression. *Child and Adolescent Psychiatric Clinics, 15*(4), 899–917.
Stewart, J. (2000). Pathways to relapse: The neurobiology of drug-and stress-induced relapse to drug-taking. *Journal of Psychiatry and Neuroscience, 25*(2), 125.
Sullivan, P. F., Neale, M. C., & Kendler, K. S. (2000). Genetic epidemiology of major depression: Review and meta-analysis. *American Journal of Psychiatry, 157*(10), 1552–1562.
Sun, H., Kennedy, P. J., & Nestler, E. J. (2013). Epigenetics of the depressed brain: Role of histone acetylation and methylation. *Neuropsychopharmacology, 38*(1), 124–137.
Suyemoto, K. L. (1998). The functions of self-mutilation. *Clinical Psychology Review, 18*(5), 531–554.
Takeuchi, D. T., Bui, K. V., & Kim, L. (1993). The referral of minority adolescents to community mental health centers. *Journal of Health and Social Behaviors, 34*, 153–164.
Takizawa, R., Maughan, B., & Arseneault, L. (2014). Adult health outcomes of childhood bullying victimization: Evidence from a five-decade longitudinal British birth cohort. *The American Journal of Psychiatry, 171*, 777–784.
Tang, Y. Y., Ma, Y., Wang, J., Fan, Y., Feng, S., Lu, Q., ... & Posner, M. I. (2007). Short-term meditation training improves attention and self-regulation. *Proceedings of the National Academy of Sciences, 104*(43), 17152–17156.
Tang, B., Liu, X., Liu, Y., Xue, C., & Zhang, L. (2014). A meta-analysis of risk factors for depression in adults and children after natural disasters. *BMC Public Health, 14*(1), 623.
Thabet, A. A. M., Abed, Y., & Vostanis, P. (2004). Comorbidity of PTSD and depression among refugee children during war conflict. *Journal of Child Psychology and Psychiatry, 45*(3), 533–542.
Thibodeau, R., Jorgensen, R. S., & Kim, S. (2006). Depression, anxiety, and resting frontal EEG asymmetry: A meta-analytic review. *Journal of Abnormal Psychology, 115*(4), 715–729.
Thompson, R. A. (1991). Emotional regulation and emotional development. *Educational Psychology Review, 3*(4), 269–307.
Thompson, R. A. (2013). Socialization of emotion and emotion regulation in the family. In J. J. Gross (Ed.), *Handbook of emotion regulation*. New York, NY: Guilford.
Thompson, R. A., Virmani, E., Waters, S. F., Meyer, S., & Raikes, A. (2013). The development of emotion self-regulation: The whole and the sum of the parts. In K. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook of self-regulatory processes in development* (pp. 5–26). New York, NY: Taylor & Francis.
Tomarken, A. J., Davidson, R. J., Wheeler, R. E., & Doss, R. C. (1992). Individual differences in anterior brain asymmetry and fundamental dimensions of emotion. *Journal of Personality and Social Psychology, 62*(4), 676–687.
Tottenham, N., Hare, T. A., Quinn, B. T., McCarry, T. W., Nurse, M., Gilhooly, T., ... & Thomas, K. M. (2010). Prolonged institutional rearing is associated with atypically large amygdala volume and difficulties in emotion regulation. *Developmental Science, 13*(1), 46–61.
Trosper, S. E., Buzzella, B. A., Bennett, S. M., & Ehrenreich, J. T. (2009). Emotion regulation in youth with emotional disorders : Implications for a unified treatment approach. *Clinical Child and Family Psychology Review, 12*, 234–254.
Tsai, J. L. (2007). Ideal affect: Cultural causes and behavioral consequences. *Perspectives on Psychological Science, 2*(3), 242–259.
Tsai, J. L., & Clobert, M. (in press). Cultural influences on emotion: Empirical patterns and emerging trends. In S. Kitayama & D. Cohen (Eds.), *Handbook of cultural psychology*. Oxford University Press.
United States Census Bureau. (2013). Poverty. Available at: http://www.census.gov/topics/income-poverty/poverty/data/tables.2013.html
Valiente, C., Fabes, R. A., Eisenberg, N., & Spinrad, T. L. (2004). The relations of parental expressivity and support to children's coping with daily stress. *Journal of Family Psychology, 18*(1), 97–106.
Vasey, M. W., Harbaugh, C. N., Lonigan, C. J., Phillips, B. M., Hankin, B. L., Willem, L., & Bijttebier, P. (2013). Dimensions of temperament and depressive symptoms: Replicating a three-way interaction. *Journal of Research in Personality, 47*(6), 908–921.

Vousoura, E., Verdeli, H., Warner, V., Wickramaratne, P., & Baily, C. D. R. (2012). Parental divorce, familial risk for depression, and psychopathology in offspring: A three-generation study. *Journal of Child and Family Studies, 21*(5), 718–725.

Wadsworth, M. E., & Santiago, C. D. (2008). Risk and resiliency processes in ethnically diverse families in poverty. *Journal of Family Psychology, 22*(3), 399.

Watson, D. (2005). Rethinking the mood and anxiety disorders: A quantitative hierarchical model for DSM-V. *Journal of Abnormal Psychology, 114*(4), 522.

Weaver, I. C., Cervoni, N., Champagne, F. A., D'Alessio, A. C., Sharma, S., Seckl, J. R., … Meaney, M. J. (2004). Epigenetic programming by maternal behavior. *Nature Neuroscience, 7*(8), 847.

Weiss, F. (2005). Neurobiology of craving, conditioned reward and relapse. *Current Opinion in Pharmacology, 5*(1), 9–19.

Weisz, J., Sandler, I. N., Durlak, J. A., & Anton, B. S. (2005). Promoting and protecting youth mental health through evidence-based prevention and treatment. *American Psychologist, 60*(6), 628–648.

Weisz, J. R., Kuppens, S., Ng, M. Y., Ugueto, A. M., Vaughn-coaxum, R., Jensen-doss, A., … Fordwood, S. R. (2017). What five decades of research tells us about the effects of youth psychological therapy: A multilevel meta-analysis and implications for science and practice. *The American Psychologist, 72*(2), 79–117.

Weisz, J. R., McCarty, C. A., & Valeri, S. M. (2006). Effects of psychotherapy for depression in children and adolescents: A meta-analysis. *Psychological Bulletin, 132*(1), 132–149.

Werner, H. (1948). *Comparative psychology of mental development*. Oxford, UK: Follett Pub. Co.

Wheeler, R. A., Twining, R. C., Jones, J. L., Slater, J. M., Grigson, P. S., & Carelli, R. M. (2008). Behavioral and electrophysiological indices of negative affect predict cocaine self-administration. *Neuron, 57*(5), 774–785.

Wikler, A. (1948). Recent progress in research on the neurophysiologic basis of morphine addiction. *American Journal of Psychiatry, 105*(5), 329–338.

Wilkinson, P. O., & Goodyer, I. M. (2011). Childhood adversity and allostatic overload of the hypothalamic–pituitary–adrenal axis: A vulnerability model for depressive disorders. *Development and Psychopathology, 23*(4), 1017–1037.

Williamson, D. E., Birmaher, B., Axelson, D. A., Ryan, N. D., & Dahl, R. E. (2004). First episode of depression in children at low and high familial risk for depression. *Journal of the American Academy of Child and Adolescent Psychiatry, 43*(3), 291–297.

Williamson, D. E., Ryan, N. D., Birmaher, B., Dahl, R. E., et al. (1995). A case-control family history study of depression in adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry, 34*, 1596–1607.

Wolff, J. C., & Ollendick, T. H. (2006). The comorbidity of conduct problems and depression in childhood and adolescence. *Clinical Child and Family Psychology Review, 9*(3-4), 201–220.

World Health Organization. (1992). *The ICD-10 classification of mental and behavioural disorders: Clinical descriptions and diagnostic guidelines*. Geneva, Switzerland: World Health Organization.

Wyman, P. A. (2014). Developmental approach to prevent adolescent suicides: Research pathways to effective upstream preventive interventions. *American Journal of Preventive Medicine, 47*(3), S251–S256.

Yap, M. B. H., Pilkington, P. D., Ryan, S. M., & Jorm, A. F. (2014). Parental factors associated with depression and anxiety in young people: A systematic review and meta-analysis. *Journal of Affective Disorders, 156*, 8–23.

Zuckerman, M. (1999). *Vulnerability to psychopathology: A biosocial model*. Washington, DC: American Psychological Association.

Emotional Development in the Context of Developmental Disorders

Jessica L. Burris, Mariya Chernenok, Tawny R. Bussey, and Susan M. Rivera

Abstract

Emotional development is a critically important process that can have major impacts across the lifespan. The current chapter explores what is known about this process in individuals with developmental disabilities, specifically autism spectrum disorder (ASD), fragile X syndrome (FXS), and Down syndrome (DS). It reviews methodological limitations of studying emotional development in developmental disorders and highlights the most prominent and promising methods for use in these special populations. We then systematically review the literature on emotional development in ASD, FXS, and DS with specific focus on recognition and processing of others' emotions, personal expressions of emotions, and emotion regulation. Finally, we discuss implications for treatment and promising future directions.

Emotion is a core component of what makes us human. Development of emotion is a critical process, which goes from aiding in basic survival early in life to defining social relationships that act as a foundation to most individuals' lives throughout adulthood. There are subgroups of individuals whose emotional processing abilities develop atypically from early in life, or whose atypical development in other domains impacts their early emotional development. Developmental disorders are a broad category that include identified genetic mutations that impact cognitive functioning and behavioral disorders that can impact social functioning while sparing cognitive abilities. Many identified developmental disorders manifest with some impairment in emotional expression, regulation, and processing. These early impairments then go on to impact the social development of these individuals throughout their lives.

It is critical to consider development, which is itself a dynamic process, as playing a crucial role

J. L. Burris
Rutgers University—Newark, Department of Psychology, Newark, NJ, USA

M. Chernenok
Human Development Graduate Group and the Center for Mind and Brain, University of California—Davis, Davis, CA, USA

T. R. Bussey
Center for Mind and Brain, University of California, Davis, CA, USA

S. M. Rivera (✉)
University of California—Davis, Department of Psychology and the Center for Mind and Brain, Davis, CA, USA
e-mail: srivera@ucdavis.edu

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_27

in the phenotypic outcomes of individuals with these disorders. Across different disorders, similar profiles of impairment could be due to completely different pathways or developmental cascades (Karmiloff-Smith, 1998). Studying emotional development in the context of developmental disorders presents a promising opportunity to elucidate the underlying mechanisms that are at play in even typical emotional development; in turn, studying atypical development can help explain not only the origins of typical behavior but also the impact of different experiences on the global development of emotion.

While there are many developmental disorders that present with relevant and distinct patterns of emotional development, the current chapter will bring together separate lines of research focusing on autism spectrum disorder, fragile X syndrome, and Down syndrome. We emphasize different levels of analysis that focus on the recognition and interpretation of other people's emotions, patterns of an individual's own emotion expression, as well as emotion regulation abilities across the lifespan. Throughout the chapter, we will highlight physiological measurement and neural processing of emotion in individuals with these developmental disorders and, importantly, will review the methodological challenges in studying emotional development in these populations.

Autism Spectrum Disorder

Autism spectrum disorder (ASD) is a pervasive neurodevelopmental disorder characterized by impaired verbal and nonverbal communication, reciprocal social interaction, and restricted and repetitive behaviors (American Psychiatric Association, 2013). The current estimated prevalence of autism is 1 in 68 children in the United States, with males 4 times more likely to be diagnosed than females (CDC, 2014). Although a singular cause of autism is not known, recent evidence suggests a combination of genetic and environmental factors (Karimi, Kamali, Mousavi, & Karahmadi, 2017; Robinson et al., 2016; Schaaf & Zoghbi, 2011). Autism is a lifelong disorder that differentially impacts those affected, with severity of impairment ranging from mild to severe. DSM-V diagnostic criteria for ASD characterizes persistent deficits in social communication and restricted-repetitive behaviors that are present in early childhood and impact daily functioning, specifying whether symptoms are accompanied by intellectual impairment, language impairment, and associated medical or genetic conditions. Further, based on these deficits, the criteria differentiate severity level of ASD, with level 1 indicating "requiring support," level 2 "requiring substantial support," and level 3 "requiring very substantial support" (American Psychiatric Association, 2013). Thus, the variability in the presence and severity of autism-related symptoms makes the disorder very heterogeneous.

Fragile X Syndrome

Fragile X syndrome (FXS) is a developmental disorder that is associated with high rates of intellectual disability (ID), attention problems, and social anxiety (Hessl et al., 2007; Cordeiro, Ballinger, Hagerman, & Hessl, 2011). FXS also has a high rate of comorbidity with ASD, with many individuals with FXS presenting clinically with restricted and repetitive interests, stereotyped behaviors and impaired social abilities (Abbeduto, McDuffie, & Thurman, 2014; Hagerman & Hagerman, 2001). The most important distinction between ASD and FXS is the identified genetic cause of FXS—an X linked disorder caused by a trinucleotide repeat (CGG) expansion on the fragile X Mental Retardation-1 (*FMR1*) gene on the X chromosome. The full mutation of the disorder occurs when this CGG repeat expansion number is greater than 200 within the 5' UTR region of the *FMR1* gene, at which point the gene becomes methylated, resulting in a loss-of-gene function (Hagerman & Hagerman, 2001). When fully methylated, the gene is silenced and no longer produces its protein product fragile X mental retardation protein (FMRP), which is crucial for proper synaptic functioning and dendritic development (Irwin, Galvez, & Greenough, 2000; Sidorov, Auerbach, & Bear, 2013). The full

mutation of the disorder occurs in approximately 1 in 2500–4000 males and 1 in 7000–8000 females (Hagerman, 2008). The premutation of the disorder, which has a mild cognitive phenotype but puts the person at risk as a carrier for passing the full mutation on to their children, is much more common, affecting between 1 in 500 males and 1 in 200 females (Hunter et al., 2012; Seltzer et al., 2012; Tassone et al., 2012).

Down Syndrome

Like FXS, Down syndrome (DS) is associated with anywhere from mild to severe intellectual disability and has an identified genetic cause. DS is most commonly caused by the presence of a third copy of the 21st chromosome (trisomy 21). This aneuploidy can be partial or complete, and a range of genetic levels of DS exist. The presence of this extra copy of the 21st chromosome leads to an increase in the expression of the protein products of genes located on the 21st chromosome (Chapman & Hesketh, 2000). While there is variability, Down syndrome presents phenotypically with some predictable patterns of physical, biological, and cognitive functioning. The physical phenotype of DS is hallmarked by neonatal hypotonia and identifiable facial and musculoskeletal morphology (Korenberg et al., 1994; Silverman, 2007).

Physical problems associated with DS include, but are not limited to, middle ear disease, problems with the immune and endocrine systems, skeletal and digestive issues, and, most markedly, cardiac defects (Epstein et al., 1991; Chapman et al., 1997). Later in life, there is also a high rate of dementia and a high comorbidity with Alzheimer's disease (Wiseman et al., 2015).

Silverman et al., 2007 reviewed the literature on the cognitive phenotype in DS and found relative weaknesses in expressive language, syntactic processing and verbal working memory, but also found that performance in most cognitive areas could be predicted by individuals' levels of overall intellectual impairment. In a study of young children with DS, Fidler, Hepburn, and Rogers (2006) found that socialization abilities were the only area that set the toddlers with DS apart from a mixed developmental disabilities group. This shows that even early in life, sociability seems to be a relative strength in DS (Fidler et al., 2005; Fidler et al., 2006).

DS and FXS, while not the most prevalent developmental disorders, are good examples of genetic disorders who present clinically with differing patterns of social and emotional abilities. These disorders can each provide a rich context in which to study the differential impact a genetic insult can have on emotional dysregulation. Alternatively, highlighting ASD, which does not have a single, identified genetic cause, but does present with marked social impairments, allows us to investigate the impacts of social impairment on emotional development.

This chapter will highlight both what is known about, and the gaps in our understanding of, emotion development in these three disorders. It will emphasize the impact these disordered developmental trajectories can have on the development of emotional processing and suggest ways in which this knowledge can facilitate the development and implementation of evidence-based treatments. Importantly, it explores the premise that investigating emotional processing in children with these developmental disorders can shed light on the underlying genetic, neural, and behavioral mechanisms that are at play in the emotional development of children who are typically developing.

Methodologies for Studying Emotion in the Context of Developmental Disorders

Before reviewing the literature on emotional development in these developmental disorders, it is important to note that some common methodologies used to study the development of emotion cannot feasibly be utilized in individuals with developmental disorders.

Parent report (typically via the completion of questionnaires) is a common method used to investigate the emotional development of the child. Parent report data is inherently limited,

given the second-hand nature of the information, as well as the very personal nature of the experience of emotion (Lagattuta, Sayfan, & Bamford, 2012). This limitation can be amplified when the child has a developmental disorder that makes it difficult for him or her to communicate their emotional experiences either due to reduced language ability or reduced emotional awareness. While some studies show that change over time in emotion expression or response to treatment can be reliably captured by parent report in children with developmental disorders (Hagerman et al., 2016), it is important to consider that in disorders such as FXS and ASD, the parents themselves have been shown to exhibit heightened levels of anxiety and depression (Cohrs & Leslie, 2017; Cordeiro et al., 2011), and those differences could influence the ratings of their children. Another large limitation of using standardized, parent-report measures is the fact that these measures have been normed on typically developing populations, so there is often a problem with floor or ceiling effects (Hessl et al., 2008).

Behavioral methods that require an overt response are often used to measure attention or reaction to emotion in typically developing children. When using these methods with children with developmental disorders, however, researchers must be careful to design paradigms that are not too cognitively challenging, and that will not overstimulate or overtax the participants.

A common problem is the interference of one area of deficit in the attempted measurement of another. For example, when asking a child with FXS about their hypothetical emotional response to a given situation, their social anxiety, attentional problems, or ability to think hypothetically may limit or alter their response, and the resulting data may reflect those areas of impairment rather than a true representation of that child's understanding of their own emotional responses.

Functional neuroimaging methods like functional magnetic resonance imaging (fMRI) are commonly used across development in a diverse number of developmental disorders. fMRI methods allow researchers to ask questions about the neural circuitry that is affected in a given disorder, and where emotional processing is concerned, the relevant structures are often medial temporal lobe areas such as amygdala, and orbitofrontal cortex. In disorders like FXS, we can investigate the direct impact that atypical genetic functioning can have on brain development and function (Hessl, Rivera, & Reiss, 2004; Kim et al., 2012; Rivera, Menon, White, Glaser, & Reiss, 2002). This can provide insight into the underlying causes of atypical aspects of emotional development and can give researchers specific neural targets for measuring efficacy of treatment efforts. Most functional neuroimaging methods require relatively significant levels of compliance, including the need for participants to follow instructions and stay still, which can be prohibitive for use in individuals with intellectual disability (ID). This often precludes use of these neuroimaging methods in populations with ID, or limits the applicability of findings to the whole disorder when only the highest cognitively functioning individuals can be included.

Event-related potentials (ERPs) have been used in populations that have less success laying supine in an MRI environment, though tolerance of the cap placement can still be challenging and the need for stillness remains a factor, though to a lesser degree than with fMRI. ERPs also have the advantage of providing an environment less likely to cause sensory over-stimulation (compared to loud, confined spaces of the MRI environment). This is an important factor given the high rate of sensory sensitivities in some populations with developmental disorders (Rogers, Hepburn, & Wehner, 2003). Passive viewing ERP paradigms (rather than those requiring instruction-following and overt motor responses like a button press) can be very helpful in studying infants and young children with developmental disorders and can thus help reveal answers to many of the interesting questions about early emotional development. While much neuroimaging research focusing on emotion investigates functioning and connectivity of the amygdala, ERP methodology cannot directly measure brain activity coming from such a subcortical structure. While this is a limitation, a substantial literature exists looking at attention-related components

that can help us understand emotional processing across development (Hajcak, MacNamara, & Olvet, 2010 for review).

Eye tracking is one very useful methodology when investigating emotional processing and can be effectively implemented across development. Eye tracking can be used in populations from very young infants to adults, and tasks that are designed to allow for passive viewing can be administered to individuals with even severe ID. Eye tracking allows for researchers to tap into attentional processes that influence emotional development across the lifespan. The method can be used to investigate many critical questions as to the mechanisms and origins of patterns of emotional development in different populations with developmental disorders.

Given the nuanced nature of testing emotional development, care must be taken in choosing and evaluating the appropriate methodology for use with different populations. The following sections of the chapter will highlight findings in ASD, FXS, and DS utilizing several methods across a wide age range of individuals. We will highlight the methodological shortcomings and modifications that were made to allow for use in these special populations.

Emotional Development in Autism Spectrum Disorder

It is broadly understood that a hallmark of ASD is disordered social-emotional processing, particularly recognizing and understanding the reciprocity of emotions in both verbal and nonverbal social interactions (Bons et al., 2013). Difficulties in processing of emotion, such as identifying and describing feelings, distinguishing bodily sensations of emotional arousal, attention to the eyes for social information, and facial expressions of emotion have been well-documented in individuals with ASD (Bons et al., 2013; Hill, Berthoz, & Frith, 2004). Some researchers have even suggested that individuals with ASD suffer from "mindblindness", or an inability to interpret others' mental states (Baron-Cohen, 1997). These observations suggest deficits in the social domain for individuals with ASD and may be a result of the inability to properly process a broad spectrum of emotional information (Philip et al., 2010).

It has been hypothesized that the hallmark social impairments seen in ASD may be consequences of an abnormally functioning "mirror neuron system" (Dapretto et al., 2006; Decety & Moriguchi, 2007; Williams, Whiten, Suddendorf, & Perrett, 2001). The findings in the literature on mirror neuron dysfunction in ASD are mixed, with some neuroimaging studies indicating a deficit in mirror neuron function in ASD (Hadjikhani, Joseph, Snyder, & Tager-Flusberg, 2006; Nishitani, Avikainen, & Hari, 2004), while others report no marked differences in the mirror neuron system of individuals with ASD (Fan, Decety, Yang, Liu, & Cheng, 2010; Pokorny et al., 2015; Pokorny, Hatt, Rogers, & Rivera, 2017; see Hamilton, 2013 for review).

Individuals with ASD are sometimes thought to lack empathy (Baron-Cohen & Wheelwright, 2004); however, Smith (2009) clarified that while individuals with ASD may have weak *cognitive empathy*, many appear to have intact *emotional empathy*; i.e., the ability to ascertain another individual's emotions and respond with similar emotion. The literature is decidedly mixed, with some studies showing a typical level of emotional empathy in high-functioning individuals with ASD (Dziobek et al., 2008), and others showing an impaired emotional empathy ability (Baron-Cohen, 2002; Minio-Paluello, Baron-Cohen, Avenanti, Walsh, & Aglioti, 2009; Williams et al., 2001). Alexithymia is a personality construct that is defined by an inability to identify and explain one's own emotional state (Bird & Cook, 2013). The literature is unclear as to the connection between alexithymia and ASD, though some have posited that alexithymia may be a co-occurring factor rather than a feature of autism, given its presence in other, unrelated disorders (Bird & Cook, 2013).

Very early in development, infants later diagnosed with ASD exhibit diminished eye contact, difficulties with joint attention, decreased social smiling, and orienting to their name (Osterling & Dawson, 1994; Ozonoff et al., 2010). As such, face processing in autism has been intensely

studied as an early indicator of downstream atypical social cognition. Studies of face processing in autism yield mixed evidence, but overall present a pattern of atypical processing of facial information present early in infancy and persisting into adulthood. Various eye tracking studies have suggested altered visual scanning of the face, with reduced time spent looking at the eyes and overall core features of the face (Chawarska & Shic, 2009; de Wit, Falck-Ytter, & von Hofsten, 2008; Jones, Carr, & Klin, 2008; Jones & Klin, 2013; Klin, Jones, Schultz, Volkmar, & Cohen, 2002; Pelphrey et al., 2002). Across studies, meta-analyses report impairments in gaze fixation to the eyes and reduced attention to social information (Papagiannopoulou, Chitty, Hermens, Hickie, & Lagopoulos, 2014); however, mixed findings of intact face scanning and social orienting emphasize the need for further investigation (Guillon, Hadjikhani, Baduel, & Rogé, 2014).

ERP studies investigating the neural processing of faces report atypical face perception in autism. Specifically, numerous studies have investigated the N170 ERP component, a neural marker of face processing, and report delayed N170 latencies that reflect slowed processing (Batty, Meaux, Wittemeyer, Rogé, & Taylor, 2011; Kang et al., 2017; McPartland, Dawson, Webb, Panagiotides, & Carver, 2004; Stavropoulos, Viktorinova, Naples, Foss-Feig, & McPartland, 2018; Webb, Dawson, Bernier, & Panagiotides, 2006). A recent fMRI meta-analysis investigating the neural correlates of emotional face processing in autism showed atypical activation in subcortical structures implicated in face processing, including the amygdala, hypothalamus, and basal ganglia (Aoki, Cortese, & Tansella, 2015). Moreover, findings report under-connectivity between the fusiform gyrus and visual cortex in individuals with autism during a face recognition task (Lynn et al., 2018). Together, this research suggests that atypical activation in subcortical structures may underlie altered perceptual encoding of faces in individuals with autism.

In addition to the documented differences in *interpreting* others' emotions, atypical *expression* of emotions has also been observed in ASD. Individuals with ASD show impaired motor empathy, or facial mimicry abilities across multiple emotions: happy, sad, fear, anger, disgust, and surprise (Bons et al., 2013). Also, Brewer et al. (2016) found the emotional expressions produced by individuals with ASD are not perceived as well as those produced by typically developing controls; interestingly, by both controls and other individuals with ASD (Brewer et al., 2016). Begeer, Koot, Rieffe, Terwogt, and Stegge (2008) showed that development plays a strong role in emotion expression, evidenced by data showing that young infants who go on to be diagnosed with ASD show emotions in a similar way to TD controls, but as age increases, their expressions tend to become less spontaneous and less socially oriented.

Emotional outbursts and tantrums can be very common in young children with ASD (Konst, Matson, & Turygin, 2013; Maskey, Warnell, Parr, Le Couteur, & McConachie, 2013; Mazefsky, Pelphrey, & Dahl, 2012; Samson, Hardan, Podell, Phillips, & Gross, 2015). Though the more traditional social and communication problems are what often lead to a child receiving an ASD diagnosis (Dawson, 2008; Dawson et al., 2010), emotional dysregulation (i.e., increased negative affect, or feelings of emotional distress and decreased positive affect) is observed and retrospectively reported by parents of children with ASD (Garon et al., 2009; Ozonoff, Williams, & Landa, 2005; Wimpory, Hobson, Williams, & Nash, 2000). These dysregulated patterns of affect continue throughout development (Mazefsky et al., 2012; White, Oswald, Ollendick, & Scahill, 2009).

Emotional and behavioral difficulties commonly seen in autism may be explained by underlying deficits in emotion regulation (ER), a process by which one regulates their own emotions behaviorally, cognitively, and physiologically (Berkovits, Eisenhower, & Blacher, 2017; Gross & Jazaieri, 2014; Mazefsky et al., 2013). Maladaptive emotion regulation skills, or emotion dysregulation, in ASD is associated with behavioral disturbances such as uncontrollable outbursts or aggression (Mazefsky & White,

2014) and have implications for anxiety and depression (Mennin, Holaway, Fresco, Moore, & Heimberg, 2007; Weiss, Thomson, & Chan, 2014). Cognitive reappraisal, an antecedent-focused regulation strategy, can be used to down-regulate negative emotional responses and reframe the situation to decrease emotional responsivity (Gross, 1998). Importantly, the ability to use cognitive reappraisal is associated with positive outcomes such as reduced mood and anxiety problems, sense of purpose in life, personal growth, and better interpersonal functioning (Gross & John, 2003). Behavioral evidence suggests that children with ASD employ more maladaptive coping strategies (e.g., increased venting, avoidance, diminished problem solving, increased resignation from task) in frustrating situations (Jahromi, Meek, & Ober-Reynolds, 2012; Konstantareas & Stewart, 2006). Emotion dysregulation has been reported to remain stable throughout childhood in ASD, with declines in social skills and atypical coping strategies that contribute to increasing internalizing and externalizing behaviors (Berkovits et al., 2017; Rieffe et al., 2011). Adolescents with ASD report involuntary employment of maladaptive ER strategies, including rumination, increased emotional arousal, and disengagement (numbing and inaction) (Mazefsky, Borue, Day, & Minshew, 2014). Further, adolescents with ASD show less frequent use of cognitive reappraisal (even when prompted to use this strategy) and instead expressive suppression (Samson et al., 2015), a pattern that continues into adulthood (Samson, Huber, & Gross, 2012). Together, these studies highlight problems in emotion regulation, present early in life and continuing throughout development.

Although multiple studies have identified emotion regulation problems in autism, further research is needed to delineate origins of these problems. To date, only a small number of studies have directly investigated the neural and physiological features of ER in autism. Further, the literature suggesting a disrupted autonomic nervous system (ANS) related to emotion regulation and social functioning in autism has yielded mixed results (see Benevides & Lane, 2015 for review). Several studies report a relationship between reduced respiratory sinus arrhythmia (RSA) amplitude and disrupted ER, internalizing/externalizing behaviors, and anxiety (Bal et al., 2010; Guy, Souders, Bradstreet, DeLussey, & Herrington, 2014; Neuhaus, Bernier, & Beauchaine, 2014). However, in a recent study of young children with ASD, researchers measured heart rate variability and ER strategies during a frustration-eliciting task. Despite difficulties in employing effective coping strategies, the underlying physiological arousal (heart rate) of emotion was intact, and differences emerged only in behavioral and expressive stages of ER (Zantinge, van Rijn, Stockmann, & Swaab, 2017).

Neuroimaging studies report abnormal prefrontal cortex (PFC)-amygdala connectivity in autism, suggesting that this contributes to problems with emotion regulation and anxiety (Swartz, Wiggins, Carrasco, Lord, & Monk, 2013). A preliminary fMRI study explored the neural mechanisms of cognitive reappraisal of disgust in children and adolescents with ASD (Pitskel, Bolling, Kaiser, Pelphrey, & Crowley, 2014). Researchers reported that although participants with ASD were able to behaviorally modulate their emotional response to disgust, they exhibited atypical neural modulation of insula and amygdala, and decreased connectivity between amygdala and prefrontal cortex (Pitskel et al., 2014). Consistent with these findings, in a study of cognitive reappraisal of faces, adults with autism showed altered activation in the nucleus accumbens, amygdala, and dPFC (Richey et al., 2015). Taken together, these studies highlight the importance of autonomic reactivity and brain connectivity associations in emotion regulation, and suggest mechanisms of disrupted emotion regulation in autism.

While on the one hand the presence of disrupted emotional development in ASD is well-documented, there are nonetheless many unanswered questions, and the literature is still mixed with regard to findings of dysfunction. Many of these contradictions in the literature may be related to the myriad of different methodological approaches to studying emotional development in ASD. It addition, ASD is inherently variable and heterogeneous, so characterizing the

entire population is not only challenging, but perhaps the incorrect level of analysis. Because of this heterogeneity, there are many studies that are aimed at subtyping individuals with ASD based on similar patterns in development (Amaral et al., 2017; Singer, 2005).

Moving forward in the study of emotional development in ASD, more studies are needed that both identify distinct emotional profiles of individuals with ASD and target the mechanisms underlying the differences seen. While we know a great deal about the behavioral manifestation of emotion dysregulation in ASD, we don't yet have a firm grasp on what is driving these differences, biologically. In the future, a more holistic approach should be taken, in which the larger context of development, including environmental impacts and the impact that cognitive factors have on emotion regulation abilities in ASD are taken into consideration. For example, it is important to consider how language or executive functioning skills (two areas of cognition that are variably impacted by ASD) impact emotional processing and regulation abilities.

Emotional Development in Fragile X Syndrome

Before exploring the literature on emotional development in FXS, it is necessary to discuss some of the challenges that exist in studying this disorder, and others with similar phenotypes, which may influence what can be known and measured in the population. Due to the X-linked nature of FXS, a large proportion of the literature focuses on only males, limiting the applicability of findings to the whole population. Given that in the majority of males with FXS the gene is thought to be methylated/silenced, focusing on males also inherently limits the amount of information we can glean about the developmental impacts of variable levels of FMRP, the protein product of the *FMR1* gene.

Another challenge in studying emotional development of children with FXS is the impact that their intellectual disability can have on their ability to participate in research studies and the way that cognitive ability may interfere with the way that we measure emotional processing. It would be unfortunate to conclude that individuals with FXS have a deficit in an area in emotional development, if in fact the deficit was due to their inability to follow the complex instructions of the task. This also highlights the need for appropriate control groups, matched on important factors such as intellectual ability, which is an area of great concern when studying groups of individuals with developmental disorders (Karmiloff-Smith, 2009).

While the FXS literature is much smaller than that of ASD, there are still a number of studies that have investigated how emotional development occurs in the context of this single gene disorder. These findings help us not only learn about how emotional development can go awry but also learn much about the underlying mechanisms that fuel emotional development in general.

One of the main behavioral challenges in FXS is the extremely heightened level of anxiety seen in this population. Cordeiro et al. (2011) reported that up to 82.5% of individuals with FXS ages 5–35 years qualified as having clinical levels of anxiety. Social phobia was more common in adults than children with FXS, but social phobia and specific phobia were the most common across development, with 58% of the sample qualifying for multiple anxiety disorder diagnoses (Cordeiro et al., 2011). Young children with FXS who do not have anxiety disorders show less attention problems, hyperactivity, and aggression than those with anxiety or those with heightened anxiety and ASD (Talisa, Boyle, Crafa, & Kaufmann, 2014). It is important to keep in mind that atypical emotional processing, including processing of other's emotions and regulating one's own emotions, may be underlying much of this anxiety.

Simon and Finucane (1996) found that adult males with FXS showed no evidence of a deficit in ability to identify emotional facial expressions. Bouras, Turk, and Cornish (1998) also found no evidence that young boys with FXS as a group have an impaired ability to recognize the expression of basic emotions. While it is widely accepted that children with FXS have social impairment, this impairment does not

seem to include or result from an impairment in either facial identification or in the basic perception of facial emotion.

Farzin, Rivera, and Hessl (2009) showed children calm, happy, fearful, and scrambled faces and found that individuals with FXS made fewer fixations to the eyes than typically developing individuals, but interestingly only for real faces (not for the scrambled face), showing that the effect was indeed face-specific. These findings are consistent with previous findings showing children, adolescents, and adults with FXS having greater avoidance of eye contact in social interactions globally (Einfeld, Tonge, & Florio, 1994). Individuals with FXS also showed greater pupillary responses to emotional faces than controls, hinting at a processing difference at the neurophysiological level (Farzin et al., 2009). Relatedly, Ballinger, Cordeiro, Chavez, Hagerman, and Hessl (2014) showed that individuals with FXS showed significantly reduced startle potentiation to fearful faces than the typically developing control group. The authors interpreted these findings as indicating differential amygdalar responsiveness to social stimuli as a contributing factor to phenotypic variability among individuals with FXS.

Kim et al. (2012) also showed atypical amygdala response in adolescents on the FX spectrum. The study showed participants neutral, happy and fearful faces in an fMRI paradigm. Results revealed an expected overall increase in amygdala activation to emotional faces, but a blunted response to fearful faces, specifically. This differed from the heightened response to fearful faces that was seen in the typically developing control participants. Furthermore, the degree of blunting of this response was directly correlated with both gene expression and anxiety level, with the most anxious and the most genetically impacted individuals showing the greatest degree of atypical amygdala response. A separate fMRI study confirmed that, while emotion recognition is relatively intact in FXS, the brain circuit responsible for such processing, and for modulating responses to emotional faces may be functioning atypically (Hagan, Hoeft, Mackey, Mobbs, & Reiss, 2008).

In a recent study, Burris et al. presented one of the first studies to investigate attention to emotional faces in young children and infants with FXS (Burris et al., 2017). It was found that when presented with emotional faces in the context of a dot probe task (a task designed to quantify implicit attentional biases) presented on an eye tracker, infants and young children with FXS showed a threat-specific attentional bias. These results suggest that the attentional systems of these young children are preferentially vigilant to detect fearful facial emotions compared to neutral faces, and more so than to happy emotions. This study indicates that, even in infancy, there is a basic difference between the way the brains of individuals with FXS are processing and reacting to fearful emotional facial displays of others.

There is some research addressing the environmental factors that underlie the emotional differences in FXS. In the context of a demanding environment, individuals with FXS are commonly unable to emotionally regulate and sometimes turn to self-injurious behavior (Hall, Lightbody, & Reiss, 2008; Symons, Clark, Hatton, Skinner, & Bailey, 2003). van Lieshout, De Meyer, Curfs, and Fryns (1998) found that some environmental factors, specifically parental anger, was negatively correlated with the emotional stability of children with FXS. Hessl et al. (2001) also reported that levels of parental psychopathology were predictive of internalizing and externalizing problems in young children with FXS. They also linked the amount of FMRP in girls with FXS to heightened levels of social withdrawal and anxious and depressed behavior. Much of the literature points to basic differences in the processing of emotions at a neural level across development in FXS, but there is evidence suggesting that environmental factors, such as parenting and maternal sensitivity, may impact emotional development in this population as well (Hauser, Kover, & Abbeduto, 2014; Smith, Hong, Greenberg, & Mailick, 2016). Importantly, these differences in neural functioning and outcomes related to environmental factors have both been directly linked to the genetic output of the impacted gene in FXS.

While much is known regarding the genetics and neural impacts, there are still many important unanswered questions about emotional development in FXS. Burris et al., 2017 demonstrated that individuals with FXS have a threat-specific bias in their attention, something that in other populations has been indicated as a risk factor for anxiety, yet we do not yet know if these biases are directly linked to anxiety levels in older individuals with FXS. Making this concrete connection could help elucidate the neural mechanism underlying emotion dysregulation in FXS and, in doing so, also shed light on the underlying mechanism that exists in the absence of this single gene disorder. In addition, understanding the impact of this gene mutation on the development of emotional attention could open doors to targeted treatment and further understanding about the genetic factors contributing to social anxiety.

Emotional Development in Down Syndrome

The literature on emotion development in DS is much smaller than that of ASD, perhaps because a large amount of the research in DS focuses on investigating the molecular genetic component of the disorder rather than the behavioral. There is, however, some work investigating emotional processing abilities of individuals with DS, and how these skills develop and change across the lifespan.

Carvajal and Iglesias (2002) reviewed the literature and found that children with and without DS present with similar patterns of emotional development when measured in terms of face-to-face interaction between mother and infant. The small differences found were attributed to difference rooted in the DS population's impairments in inhibitory control. These findings highlight the important impact that level of intellectual disability may have on patterns of emotional development.

There are mixed findings in the literature focusing on face processing in DS. Annaz, Karmiloff-Smith, Johnson, and Thomas (2009) found that when compared with both high- and low-functioning groups of children with ASD and children with Williams syndrome, children with DS processed holistic faces better than isolated features of faces. They outperformed all other groups in recognizing an upright whole face. In adults with DS, emotional face processing was impacted by perseverative errors to the lower half of the face, a pattern not shown by a group of intellectually disabled peers (Carvajal, Fernández-Alcaraz, Rueda, & Sarrión, 2012). Kasari, Freeman, and Hughes (2001) showed that children with DS can correctly identify emotional facial expressions, but not at the level of chronologically age-matched peers, indicating a present but impaired skill. Interestingly, when mistakes were made by children with DS, they were most likely mislabeling negative emotions as positive emotions. Unsurprisingly, the young children with DS in this study struggled to verbally label the emotions and struggled as the difficulty of the task increased. In a 2-year follow-up of this study sample, it was shown that the participants with DS showed no change in abilities to identify or recognize emotions as they aged. Porter, Coltheart, and Langdon (2007) saw a similar impairment in identification and labeling of emotion, but only for negative emotions, with the group again often labeling negative emotions as positive, and exhibiting specific difficulty when labeling sadness. Similarly, children with DS struggle to match surprise and fearful facial expressions (Wishart & Pitcairn, 2002; Williams, Wishart, Pitcairn, & Willis, 2005).

When it comes to individuals' experience or expression of emotion, individuals with DS present with a distinct pattern when compared to those who are typically developing and those with other developmental disorders or intellectual impairment. Evidence suggests that children with DS may show more positive emotional signals overall than other children with ID. Fidler and Barrett (2006) showed that children with DS smiled more frequently than other groups of children with ID. Interestingly these results changed as individuals with DS aged, with no difference being shown by adulthood. It has been hypothesized that children with DS may tend to rely heavily on their positive emotional responses

and social skills to compensate for their weaker areas of cognitive functioning (Freeman & Kasari, 2002).

In a study investigating expression of empathy in school-aged children with DS, Kasari, Freeman, and Bass (2003) found that children with DS demonstrated prosocial behavior when shown an experimenter in distress but failed to react empathically when shown a socioemotional vignette featuring different emotions. This shows that children with DS can show an empathic emotional response to others, but that this skill may be context dependent. Very little research has been done on emotional regulation in DS, though Bieberich and Morgan (2004) showed that when compared to ASD peers, individuals with DS show more stable levels of self-regulation over time and present greater positive affect stability, overall.

What We Can Learn About Emotion Development from Studying Developmental Disorders?

Studying emotional development within atypically developing populations of children presents a promising opportunity to build a framework in which we can track the cascade of underlying processes that influence emotional development in the general population. By looking at an identified developmental disorder, we can think of this developmental cascade as starting with atypical neural circuitry which can lead to altered physiological and biological responses that then relate to deficits in executive functions like global attention, cognitive control, and cognitive inhibition. In turn, these conditions can impact patterns of face processing that can lead to downstream deficits in emotion regulation and recognition of emotion, which eventually may lead to impairments in social and communication skills. Thus, using atypical development as a model, we can work backward up the developmental cascade to attain a greater understanding of which factors are most impactful in typical emotional development. Based on the classic principles of multifinality, we know that there are multiple pathways to get to the same phenotypic outcome in development. Utilizing patterns of emotional development shown in developmental disorders can help us highlight the impact that these specific divergent pathways can have on emotional outcomes (Cicchetti & Rogosch, 1996).

Furthermore, looking at emotional development through the lens of atypical development allows us to take a cognitive neuroscience approach, given that the perturbations we see in these disorders allow us to investigate specialization of brain regions and their respective functions. Indeed, as lesion studies have well demonstrated, working backwards from insults in development can allow us to reach conclusions that would not have been possible without these models of atypical development.

Within this developmental cascade and neuroscience framework, there are numerous domains in which we can highlight the importance of studying atypical development. Utilizing developmental disorders, we can focus on developmental timing and the role that global development has on emotional development specifically. One example of developmental timing that can be aided by the investigation of atypical development is sensitive and critical periods (Johnson, 2005). Developmental disorders can provide great insight into the timing and flexibility of these crucial periods in development and how development itself, along with individual experiences, come together to influence outcomes (Karmiloff-Smith, 2018). Studies within this framework often focus on sensory domains in developmental disorders, but we argue here that great insights can also be gained from studying emotional development in developmental disorders.

There is also much to be learned from examining the role of individual differences across groups of children who are both atypically and typically developing. Often in research focusing on typical development, there is a false assumption of homogeneity. In the literature of developmental disorders, we see that there are many factors that can impact outcomes, and that these factors may differ across individuals. As an example, fragile X syndrome allows us to

investigate a titrated contribution of the *FMR1* gene, and evidence has shown that individual levels of involvement of this gene are linked with behavioral, psychophysiological and neural outcomes (Kim et al., 2012).

Studying emotional development in developmental disorders also affords us an opportunity to investigate compensatory mechanisms early in life, and the impact of neural plasticity, which can be an important tool for the development of interventions, but also helps us learn about different pathways that could be in place in typical emotional development.

Unanswered Questions and Future Directions

Arguably, the most important unanswered question in the literature on these developmental disorders is that of how to treat emotional dysregulation and anxiety in these populations. Before evidence-based and individually tailored treatments can be developed, however, there are still many questions regarding the basic, biological mechanisms underlying these deficits and, critically, how these mechanisms develop over the lifespan that have yet to be answered.

One such avenue for treatment of emotional problems in disorders (such as FXS) that presents with a specific attentional bias toward threat is attention bias modification (ABM) (Amir, Beard, Burns, & Bomyea, 2009; Bar-Haim, 2010; Hakamata et al., 2010). ABM treatment focuses on systematically training individuals who have an attention bias toward threat to either attend more toward positive or neutral stimuli instead of focusing on threatening stimulus. This type of attention training paradigm could be a prime candidate for use with a population with intellectual disability, given that it can be passive viewing. A 2017 review highlights the technique as a promising new avenue to treat the emotional underpinnings of anxiety but cautions against overinterpretation of the literature, given the small effect sizes and replication failures (Mogg, Waters, & Bradley, 2017).

There are many behavioral therapies that have been utilized to treat ASD in young children, ranging from after-school social skills training groups to intensive one-on-one therapy with a clinician. While an emotional component is incorporated into most of these behavioral interventions, some of these treatments highlight this domain more than others. A primary goal of the Early Start Denver Model (ESDM) is to target deficits in socio-emotional and communication domains that are impacted in ASD. Emotion sharing is one of the key domains of ESDM (Rogers & Dawson, 2010) and as such, ESDM treatment focuses heavily on fostering greater eye contact and facial gaze, which could improve emotional facial expression processing and encourage emotional mirroring.

Computer game-based interventions that focus on social skills training and emotion recognition training are also gaining popularity. In a 2017 review, Grossard et al. identified 31 such game-based interventions that target teaching social skills and emotion recognition. While there are some aspects of these therapeutic games that are encouraging, such as their appeal to the targeted population, there are still many shortcomings. In the majority of cases, these methods are still targeting only high-functioning individuals, and they still tend to not meet standards of treatment efficacy required for clinical trials. Thus, while therapeutic game-based techniques are promising, they still have a way to go before being applicable across the full spectrum of individuals with developmental disorders that exhibit atypical emotional development.

It is clear from the literature that developmental disorders like ASD, FXS, and DS come with varied profiles of atypical emotional development. These atypical patterns include components of emotional processing from interpreting and reacting to others' emotions and expression and regulation of one's own emotions and can be identified at the behavioral, physiological, neural, and genetic levels. They clearly impact the phenotype of these disorders, and in some cases, are defining components in their presentation. Many developmental factors play a role in these atypical patterns of emotion, with some studies

documenting change over time, and others pointing to individual differences related to parenting factors, environmental factors and cognition. Future research directions should therefore focus on studies that include a range of ages and phenotypic presentations, and should employ methods that both tap into underlying biological processes and that can be used across a range of cognitive abilities.

References

Abbeduto, L., McDuffie, A., & Thurman, A. J. (2014). The fragile X syndrome–autism comorbidity: What do we really know? *Frontiers in Genetics, 5*, 355.

Amaral, D. G., Li, D., Libero, L., Soloman, M., Van de Water, J., Mastergeorge, A., … Wu Nordahl, C. (2017). In pursuit of neurophenotypes: The consequences of having autism and a big brain. *Autism Research, 10*(5), 711–722.

Amir, N., Beard, C., Burns, M., & Bomyea, J. (2009). Attention modification program in individuals with generalized anxiety disorder. *Journal of Abnormal Psychology, 118*(1), 28.

Annaz, D., Karmiloff-Smith, A., Johnson, M. H., & Thomas, M. S. (2009). A cross-syndrome study of the development of holistic face recognition in children with autism, down syndrome, and Williams syndrome. *Journal of Experimental Child Psychology, 102*(4), 456–486.

Aoki, Y., Cortese, S., & Tansella, M. (2015). Neural bases of atypical emotional face processing in autism: A meta-analysis of fMRI studies. *The World Journal of Biological Psychiatry, 16*(5), 291–300.

Bal, E., Harden, E., Lamb, D., Van Hecke, A. V., Denver, J. W., & Porges, S. W. (2010). Emotion recognition in children with autism spectrum disorders: Relations to eye gaze and autonomic state. *Journal of Autism and Developmental Disorders, 40*(3), 358–370.

Ballinger, E. C., Cordeiro, L., Chavez, A. D., Hagerman, R. J., & Hessl, D. (2014). Emotion potentiated startle in fragile X syndrome. *Journal of Autism and Developmental Disorders, 44*(10), 2536–2546.

Bar-Haim, Y. (2010). Research review: Attention bias modification (ABM): A novel treatment for anxiety disorders. *Journal of Child Psychology and Psychiatry, 51*(8), 859–870.

Baron-Cohen, S. (1997). *Mindblindness: An essay on autism and theory of mind*. Cambridge, MA: MIT press.

Baron-Cohen, S. (2002). The extreme male brain theory of autism. *Trends in Cognitive Sciences, 6*(6), 248–254.

Baron-Cohen, S., & Wheelwright, S. (2004). The empathy quotient: An investigation of adults with Asperger syndrome or high functioning autism, and normal sex differences. *Journal of Autism and Developmental Disorders, 34*(2), 163–175.

Batty, M., Meaux, E., Wittemeyer, K., Rogé, B., & Taylor, M. J. (2011). Early processing of emotional faces in children with autism: An event-related potential study. *Journal of Experimental Child Psychology, 109*(4), 430–444.

Begeer, S., Koot, H. M., Rieffe, C., Terwogt, M. M., & Stegge, H. (2008). Emotional competence in children with autism: Diagnostic criteria and empirical evidence. *Developmental Review, 28*(3), 342–369.

Berkovits, L., Eisenhower, A., & Blacher, J. (2017). Emotion regulation in young children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 47*(1), 68–79.

Benevides, T. W., & Lane, S. J. (2015). A review of cardiac autonomic measures: Considerations for examination of physiological response in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 45*(2), 560–575.

Bieberich, A. A., & Morgan, S. B. (2004). Self-regulation and affective expression during play in children with autism or down syndrome: A short-term longitudinal study. *Journal of Autism and Developmental Disorders, 34*(4), 439–448.

Bird, G., & Cook, R. (2013). Mixed emotions: The contribution of alexithymia to the emotional symptoms of autism. *Translational Psychiatry, 3*(7), e285.

Bons, D., van den Broek, E., Scheepers, F., Herpers, P., Rommelse, N., & Buitelaaar, J. K. (2013). Motor, emotional, and cognitive empathy in children and adolescents with autism spectrum disorder and conduct disorder. *Journal of Abnormal Child Psychology, 41*(3), 425–443.

Bouras, N., Turk, J., & Cornish, K. (1998). Face recognition and emotion perception in boys with fragile-X syndrome. *Journal of Intellectual Disability Research, 42*(6), 490–499.

Brewer, R., Biotti, F., Catmur, C., Press, C., Happé, F., Cook, R., & Bird, G. (2016). Can neurotypical individuals read autistic facial expressions? Atypical production of emotional facial expressions in autism spectrum disorders. *Autism Research, 9*(2), 262–271.

Burris, J. L., Barry-Anwar, R. A., & Rivera, S. M. (2017). An eye tracking investigation of attentional biases towards affect in young children. *Developmental Psychology, 53*(8), 1418.

Burris, J. L., Barry-Anwar, R. A., Sims, R. N., Hagerman, R. J., Tassone, F., & Rivera, S. M. (2017). Children with fragile X syndrome display threat-specific biases toward emotion. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging, 2*(6), 487–492.

Carvajal, F., & Iglesias, J. (2002). Face-to-face emotion interaction studies in down syndrome infants. *International Journal of Behavioral Development, 26*(2), 104–112.

Carvajal, F., Fernández-Alcaraz, C., Rueda, M., & Sarrión, L. (2012). Processing of facial expressions of emotions by adults with down syndrome and moderate intellectual disability. *Research in Developmental Disabilities, 33*(3), 783–790.

Chapman, R. S., & Hesketh, L. J. (2000). Behavioral phenotype of individuals with down syndrome. *Mental Retardation and Developmental Disabilities Research Reviews, 6*(2), 84–95.

Chawarska, K., & Shic, F. (2009). Looking but not seeing: Atypical visual scanning and recognition of faces in 2 and 4-year-old children with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 39*(12), 1663.

Cicchetti, D., & Rogosch, F. A. (1996). Equifinality and multifinality in developmental psychopathology. *Development and Psychopathology, 8*, 597–600.

Cohrs, A. C., & Leslie, D. L. (2017). Depression in parents of children diagnosed with autism spectrum disorder: A claims-based analysis. *Journal of Autism and Developmental Disorders, 47*(5), 1416–1422.

Cordeiro, L., Ballinger, E., Hagerman, R., & Hessl, D. (2011). Clinical assessment of DSM-IV anxiety disorders in fragile X syndrome: Prevalence and characterization. *Journal of Neurodevelopmental Disorders, 3*(1), 57.

Dapretto, M., Davies, M. S., Pfeifer, J. H., Scott, A. A., Sigman, M., Bookheimer, S. Y., & Iacoboni, M. (2006). Understanding emotions in others: Mirror neuron dysfunction in children with autism spectrum disorders. *Nature Neuroscience, 9*(1), 28.

Dawson, G. (2008). Early behavioral intervention, brain plasticity, and the prevention of autism spectrum disorder. *Development and Psychopathology, 20*(3), 775–803.

Dawson, G., Rogers, S., Munson, J., Smith, M., Winter, J., Greenson, J., … Varley, J. (2010). Randomized, controlled trial of an intervention for toddlers with autism: The Early Start Denver Model. *Pediatrics, 125*(1), e17–e23.

de Wit, T. C., Falck-Ytter, T., & von Hofsten, C. (2008). Young children with autism spectrum disorder look differently at positive versus negative emotional faces. *Research in Autism Spectrum Disorders, 2*(4), 651–659.

Decety, J., & Moriguchi, Y. (2007). The empathic brain and its dysfunction in psychiatric populations: Implications for intervention across different clinical conditions. *Biopsychosocial Medicine, 1*(1), 22.

Dziobek, I., Rogers, K., Fleck, S., Bahnemann, M., Heekeren, H. R., Wolf, O. T., & Convit, A. (2008). Dissociation of cognitive and emotional empathy in adults with Asperger syndrome using the Multifaceted Empathy Test (MET). *Journal of Autism and Developmental Disorders, 38*(3), 464–473.

Einfeld, S. L., Tonge, B. J., & Florio, T. (1994). Behavioural and emotional disturbance in fragile X syndrome. *American Journal of Medical Genetics Part A, 51*(4), 386–391.

Epstein, C. J., Korenberg, J. R., Annerén, G., Antonarakis, S. E., Aymé, S., Courchesne, E., … Huret, J. L. (1991). Protocols to establish genotype-phenotype correlations in down syndrome. *American Journal of Human Genetics, 49*(1), 207.

Fan, Y. T., Decety, J., Yang, C. Y., Liu, J. L., & Cheng, Y. (2010). Unbroken mirror neurons in autism spectrum disorders. *Journal of Child Psychology and Psychiatry, 51*(9), 981–988.

Farzin, F., Rivera, S. M., & Hessl, D. (2009). Brief report: Visual processing of faces in individuals with fragile X syndrome: An eye tracking study. *Journal of Autism and Developmental Disorders, 39*(6), 946–952.

Fidler, D. J. (2005). The emerging down syndrome behavioral phenotype in early childhood: Implications for practice. *Infants & Young Children, 18*(2), 86–103.

Fidler, D., Hepburn, S., & Rogers, S. (2006). Early learning and adaptive behaviour in toddlers with down syndrome: Evidence for an emerging behavioural phenotype? *Down Syndrome Research and Practice, 9*(3), 37–44.

Freeman, S. F., & Kasari, C. (2002). Characteristics and qualities of the play dates of children with down syndrome: Emerging or true friendships? *American Journal on Mental Retardation, 107*(1), 16–31.

Garon, N., Bryson, S. E., Zwaigenbaum, L., Smith, I. M., Brian, J., Roberts, W., & Szatmari, P. (2009). Temperament and its relationship to autistic symptoms in a high-risk infant sib cohort. *Journal of Abnormal Child Psychology, 37*(1), 59–78.

Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2*(3), 271.

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology, 85*(2), 348.

Gross, J. J., & Jazaieri, H. (2014). Emotion, emotion regulation, and psychopathology: An affective science perspective. *Clinical Psychological Science, 2*(4), 387–401.

Grossard, C., Grynspan, O., Serret, S., Jouen, A. L., Bailly, K., & Cohen, D. (2017). Serious games to teach social interactions and emotions to individuals with autism spectrum disorders (ASD). *Computers & Education, 113*, 195–211.

Guillon, Q., Hadjikhani, N., Baduel, S., & Rogé, B. (2014). Visual social attention in autism spectrum disorder: Insights from eye tracking studies. *Neuroscience & Biobehavioral Reviews, 42*, 279–297.

Guy, L., Souders, M., Bradstreet, L., DeLussey, C., & Herrington, J. D. (2014). Brief report: Emotion regulation and respiratory sinus arrhythmia in autism spectrum disorder. *Journal of Autism and Developmental Disorders, 44*(10), 2614–2620.

Hadjikhani, N., Joseph, R. M., Snyder, J., & Tager-Flusberg, H. (2006). Anatomical differences in the mirror neuron system and social cognition network in autism. *Cerebral Cortex, 16*(9), 1276–1282.

Hagan, C. C., Hoeft, F., Mackey, A., Mobbs, D., & Reiss, A. L. (2008). Aberrant neural function during emotion attribution in female subjects with fragile X syndrome. *Journal of the American Academy of Child & Adolescent Psychiatry, 47*(12), 1443–1454.

Hagerman, R. J., & Hagerman, P. J. (2001). Fragile X syndrome: A model of gene-brain-behavior relationships. *Molecular Genetics and Metabolism, 74*(1), 89–97.

Hagerman, P. J. (2008). The fragile X prevalence paradox. *Journal of Medical Genetics, 45*, 498.

Hagerman, R. J., & Hagerman, P. (2016). Fragile X-associated tremor/ataxia syndrome—Features, mechanisms and management. *Nature Reviews Neurology, 12*(7), 403.

Hajcak, G., MacNamara, A., & Olvet, D. M. (2010). Event-related potentials, emotion, and emotion regulation: An integrative review. *Developmental Neuropsychology, 35*(2), 129–155.

Hakamata, Y., Lissek, S., Bar-Haim, Y., Britton, J. C., Fox, N. A., Leibenluft, E., … Pine, D. S. (2010). Attention bias modification treatment: A meta-analysis toward the establishment of novel treatment for anxiety. *Biological Psychiatry, 68*(11), 982–990.

Hall, S. S., Lightbody, A. A., & Reiss, A. L. (2008). Compulsive, self-injurious, and autistic behavior in children and adolescents with fragile X syndrome. *American Journal on Mental Retardation, 113*(1), 44–53.

Hamilton, A. F. (2013). Reflecting on the mirror neuron system in autism: A systematic review of current theories. *Developmental Cognitive Neuroscience, 3*(1), 91–105.

Hauser, C., Kover, S., & Abbeduto, L. (2014). Maternal well-being and child behavior in families with fragile X syndrome. *Research in Developmental Disabilities, 35*(10), 2477–2486.

Hessl, D., Dyer-Friedman, J., Glaser, B., Wisbeck, J., Barajas, R. G., Taylor, A., & Reiss, A. L. (2001). The influence of environmental and genetic factors on behavior problems and autistic symptoms in boys and girls with fragile X syndrome. *Pediatrics, 108*(5), e88.

Hessl, D., Rivera, S. M., & Reiss, A. L. (2004). The neuroanatomy and neuroendocrinology of fragile X syndrome. *Developmental Disabilities Research Reviews, 10*(1), 17–24.

Hessl, D., Tassone, F., Cordeiro, L., Koldewyn, K., McCormick, C., Green, C., … Hagerman, R. J. (2008). Brief report: Aggression and stereotypic behavior in males with fragile X syndrome—Moderating secondary genes in a "single gene" disorder. *Journal of Autism and Developmental Disorders, 38*(1), 184–189.

Hill, E., Berthoz, S., & Frith, U. (2004). Brief report: Cognitive processing of own emotions in individuals with autistic spectrum disorder and in their relatives. *Journal of Autism and Developmental Disorders, 34*(2), 229–235.

Hunter, J. E., Leslie, M., Novak, G., Hamilton, D., Shubeck, L., Charen, K., … Cubells, J. F. (2012). Depression and anxiety symptoms among women who carry the FMR1 premutation: Impact of raising a child with fragile X syndrome is moderated by CRHR1 polymorphisms. *American Journal of Medical Genetics Part B: Neuropsychiatric Genetics, 159*(5), 549–559.

Irwin, S. A., Galvez, R., & Greenough, W. T. (2000). Dendritic spine structural anomalies in fragile-X mental retardation syndrome. *Cerebral Cortex, 10*(10), 1038–1044.

Jahromi, L. B., Meek, S. E., & Ober-Reynolds, S. (2012). Emotion regulation in the context of frustration in children with high functioning autism and their typical peers. *Journal of Child Psychology and Psychiatry, 53*(12), 1250–1258.

Johnson, M. H. (2005). Sensitive periods in functional brain development: Problems and prospects. *Developmental Psychobiology: The Journal of the International Society for Developmental Psychobiology, 46*(3), 287–292.

Jones, W., Carr, K., & Klin, A. (2008). Absence of preferential looking to the eyes of approaching adults predicts level of social disability in 2-year-old toddlers with autism spectrum disorder. *Archives of General Psychiatry, 65*(8), 946–954.

Jones, W., & Klin, A. (2013). Attention to eyes is present but in decline in 2–6-month-old infants later diagnosed with autism. *Nature, 504*(7480), 427.

Kang, E., Keifer, C. M., Levy, E. J., Foss-Feig, J. H., Mcpartland, J. C., & Lerner, M. D. (2017). Atypicality of the N170 event-related potential in autism spectrum disorder: A meta-analysis. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging., 3*, 657. https://doi.org/10.1016/j.bpsc.2017.11.003

Karimi, P., Kamali, E., Mousavi, S. M., & Karahmadi, M. (2017). Environmental factors influencing the risk of autism. *Journal of Research in Medical Sciences: The Official Journal of Isfahan University of Medical Sciences, 22*, 27.

Karmiloff-Smith, A. (1997). Crucial differences between developmental cognitive neuroscience and adult neuropsychology. *Developmental Neuropsychology, 13*(4), 513–524.

Karmiloff-Smith, A. (1998). Development itself is the key to understanding developmental disorders. *Trends in Cognitive Sciences, 2*(10), 389–398.

Karmiloff-Smith, A. (2009). Nativism versus neuroconstructivism: Rethinking the study of developmental disorders. *Developmental Psychology, 45*(1), 56.

Karmiloff-Smith, A. (2018). Development itself is the key to understanding developmental disorders. In *Thinking developmentally from constructivism to neuroconstructivism* (pp. 97–117). Routledge.

Kasari, C., Freeman, S. F., & Hughes, M. A. (2001). Emotion recognition by children with down syndrome. *American Journal on Mental Retardation, 106*(1), 59–72.

Kasari, C., Freeman, S. F., & Bass, W. (2003). Empathy and response to distress in children with down syndrome. *Journal of Child Psychology and Psychiatry, 44*(3), 424–431.

Kim, S. Y., Burris, J., Bassal, F., Koldewyn, K., Chattarji, S., Tassone, F., … Rivera, S. M. (2012). Fear-specific amygdala function in children and adolescents on the fragile x spectrum: A dosage response of the FMR1 gene. *Cerebral Cortex, 24*(3), 600–613.

Klin, A., Jones, W., Schultz, R., Volkmar, F., & Cohen, D. (2002). Visual fixation patterns during viewing of naturalistic social situations as predictors of social competence in individuals with autism. *Archives of General Psychiatry, 59*(9), 809–816.

Konst, M. J., Matson, J. L., & Turygin, N. (2013). Comparing the rates of tantrum behavior in children with ASD and ADHD as well as children with comorbid ASD and ADHD diagnoses. *Research in Autism Spectrum Disorders, 7*(11), 1339–1345.

Konstantareas, M. M., & Stewart, K. (2006). Affect regulation and temperament in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 36*(2), 143–154.

Korenberg, J. R., Chen, X. N., Schipper, R., Sun, Z., Gonsky, R., Gerwehr, S., … Disteche, C. (1994). Down syndrome phenotypes: The consequences of chromosomal imbalance. *Proceedings of the National Academy of Sciences, 91*(11), 4997–5001.

Lagattuta, K. H., Sayfan, L., & Bamford, C. (2012). Do you know how I feel? Parents underestimate worry and overestimate optimism compared to child self-report. *Journal of Experimental Child Psychology, 113*(2), 211–232.

Loesch, D. Z., Bui, Q. M., Dissanayake, C., Clifford, S., Gould, E., Bulhak-Paterson, D., … Huggins, R. M. (2007). Molecular and cognitive predictors of the continuum of autistic behaviours in fragile X. *Neuroscience & Biobehavioral Reviews, 31*(3), 315–326.

Lynn, A. C., Padmanabhan, A., Simmonds, D., Foran, W., Hallquist, M. N., Luna, B., & O'Hearn, K. (2018). Functional connectivity differences in autism during face and car recognition: Underconnectivity and atypical age-related changes. *Developmental Science, 21*(1). https://doi.org/10.1111/desc.12508

Mazefsky, C. A., Pelphrey, K. A., & Dahl, R. E. (2012). The need for a broader approach to emotion regulation research in autism. *Child Development Perspectives, 6*(1), 92–97.

Mazefsky, C. A., Herrington, J., Siegel, M., Scarpa, A., Maddox, B. B., Scahill, L., & White, S. W. (2013). The role of emotion regulation in autism spectrum disorder. *Journal of the American Academy of Child & Adolescent Psychiatry, 52*(7), 679–688.

Maskey, M., Warnell, F., Parr, J. R., Le Couteur, A., & McConachie, H. (2013). Emotional and behavioural problems in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 43*(4), 851–859.

Mazefsky, C. A., Borue, X., Day, T. N., & Minshew, N. J. (2014). Emotion regulation patterns in adolescents with high-functioning autism spectrum disorder: Comparison to typically developing adolescents and association with psychiatric symptoms. *Autism Research, 7*(3), 344–354.

McPartland, J., Dawson, G., Webb, S. J., Panagiotides, H., & Carver, L. J. (2004). Event-related brain potentials reveal anomalies in temporal processing of faces in autism spectrum disorder. *Journal of Child Psychology and Psychiatry, 45*(7), 1235–1245.

Mennin, D. S., Holaway, R. M., Fresco, D. M., Moore, M. T., & Heimberg, R. G. (2007). Delineating components of emotion and its dysregulation in anxiety and mood psychopathology. *Behavior Therapy, 38*(3), 284–302.

Minio-Paluello, I., Baron-Cohen, S., Avenanti, A., Walsh, V., & Aglioti, S. M. (2009). Absence of embodied empathy during pain observation in Asperger syndrome. *Biological Psychiatry, 65*(1), 55–62.

Mogg, K., Waters, A. M., & Bradley, B. P. (2017). Attention bias modification (abm): Review of effects of multisession abm training on anxiety and threat-related attention in high-anxious individuals. *Clinical Psychological Science, 5*(4), 698–717.

Neuhaus, E., Bernier, R., & Beauchaine, T. P. (2014). Brief report: Social skills, internalizing and externalizing symptoms, and respiratory sinus arrhythmia in autism. *Journal of Autism and Developmental Disorders, 44*(3), 730–737.

Nishitani, N., Avikainen, S., & Hari, R. (2004). Abnormal imitation- related cortical activation sequences in Asperger's syndrome. *Annals of Neurology, 55*(4), 558–562.

Olsson, M. B., & Hwang, C. P. (2001). Depression in mothers and fathers of children with intellectual disability. *Journal of Intellectual Disability Research, 45*. (Pt 6, 535–543.

Osterling, J., & Dawson, G. (1994). Early recognition of children with autism: A study of first birthday home videotapes. *Journal of Autism and Developmental Disorders, 24*(3), 247–257.

Ozonoff, S., Williams, B. J., & Landa, R. (2005). Parental report of the early development of children with regressive autism: The delays-plus-regression phenotype. *Autism, 9*, 461–486. https://doi.org/10.1177/1362361305057880

Ozonoff, S., Iosif, A. M., Baguio, F., Cook, I. C., Hill, M. M., Hutman, T., … Steinfeld, M. B. (2010). A prospective study of the emergence of early behavioral signs of autism. *Journal of the American Academy of Child & Adolescent Psychiatry, 49*(3), 256–266.

Papagiannopoulou, E. A., Chitty, K. M., Hermens, D. F., Hickie, I. B., & Lagopoulos, J. (2014). A systematic review and meta-analysis of eye-tracking studies in children with autism spectrum disorders. *Social Neuroscience, 9*(6), 610–632.

Pelphrey, K. A., Sasson, N. J., Reznick, J. S., Paul, G., Goldman, B. D., & Piven, J. (2002). Visual scanning of faces in autism. *Journal of Autism and Developmental Disorders, 32*(4), 249–261.

Philip, R. C. M., Whalley, H. C., Stanfield, A. C., Sprengelmeyer, R., Santos, I. M., Young, A. W., … Hall, J. (2010). Deficits in facial, body movement and vocal emotional processing in autism spectrum disorders. *Psychological Medicine, 40*(11), 1919–1929.

Pitskel, N. B., Bolling, D. Z., Kaiser, M. D., Pelphrey, K. A., & Crowley, M. J. (2014). Neural systems for cognitive reappraisal in children and adolescents with autism spectrum disorder. *Developmental Cognitive Neuroscience, 10*, 117–128.

Pokorny, J. J., Hatt, N. V., Colombi, C., Vivanti, G., Rogers, S. J., & Rivera, S. M. (2015). The action observation system when observing hand actions in autism and typical development. *Autism Research, 8*(3), 284–296.

Pokorny, J., Hatt, N. V., Rogers, S. J., & Rivera, S. M. (2017). What are you doing with that object? Comparing the neural responses of action understanding in adolescents with and without autism. *Journal of Autism and Developmental Disorders., 48*, 809. https://doi.org/10.1007/s10803-017-3338-3

Porter, M. A., Coltheart, M., & Langdon, R. (2007). The neuropsychological basis of hypersociability in Williams and down syndrome. *Neuropsychologia, 45*(12), 2839–2849.

Rieffe, C., Oosterveld, P., Terwogt, M. M., Mootz, S., Van Leeuwen, E., & Stockmann, L. (2011). Emotion regulation and internalizing symptoms in children with autism spectrum disorders. *Autism, 15*(6), 655–670.

Richey, J. A., Damiano, C. R., Sabatino, A., Rittenberg, A., Petty, C., Bizzell, J., … Davidson, R. J. (2015). Neural mechanisms of emotion regulation in autism spectrum disorder. *Journal of Autism and Developmental Disorders, 45*(11), 3409–3423.

Rivera, S. M., Menon, V., White, C. D., Glaser, B., & Reiss, A. L. (2002). Functional brain activation during arithmetic processing in females with fragile X syndrome is related to FMR1 protein expression. *Human Brain Mapping, 16*(4), 206–218.

Robinson, E. B., St Pourcain, B., Anttila, V., Kosmicki, J. A., Bulik-Sullivan, B., Grove, J., … Martin, J. (2016). Genetic risk for autism spectrum disorders and neuropsychiatric variation in the general population. *Nature Genetics, 48*(5), 552.

Rogers, S. J., Hepburn, S., & Wehner, E. (2003). Parent reports of sensory symptoms in toddlers with autism and those with other developmental disorders. *Journal of Autism and Developmental Disorders, 33*(6), 631–642.

Rogers, S. J., & Dawson, G. (2010). *Early Start Denver Model for young children with autism: Promoting language, learning, and engagement*. New York, NY: Guilford Press.

Samson, A. C., Huber, O., & Gross, J. J. (2012). Emotion regulation in Asperger's syndrome and high-functioning autism. *Emotion, 12*(4), 659.

Samson, A. C., Hardan, A. Y., Podell, R. W., Phillips, J. M., & Gross, J. J. (2015). Emotion regulation in children and adolescents with autism spectrum disorder. *Autism Research, 8*(1), 9–18.

Schaaf, C. P., & Zoghbi, H. Y. (2011). Solving the autism puzzle a few pieces at a time. *Neuron, 70*(5), 806–808.

Seltzer, M. M., Barker, E. T., Greenberg, J. S., Hong, J., Coe, C., & Almeida, D. (2012). Differential sensitivity to life stress in FMR1 premutation carrier mothers of children with fragile X syndrome. *Health Psychology, 31*(5), 612.

Sidorov, M. S., Auerbach, B. D., & Bear, M. F. (2013). Fragile X mental retardation protein and synaptic plasticity. *Molecular Brain, 6*(1), 15.

Silverman, W. (2007). Down syndrome: Cognitive phenotype. *Mental Retardation and Developmental Disabilities Research Reviews, 13*(3), 228–236.

Simon, E. W., & Finucane, B. M. (1996). Facial emotion identification in males with fragile X syndrome. *American Journal of Medical Genetics Part A, 67*(1), 77–80.

Singer, E. (2005). 'Phenome' project set to pin down subgroups of autism. *Nature Medicine, 11*(6), 583.

Smith, A. (2009). The empathy imbalance hypothesis of autism: A theoretical approach to cognitive and emotional empathy in autistic development. *The Psychological Record, 59*(3), 489–510.

Smith, L. E., Hong, J., Greenberg, J. S., & Mailick, M. R. (2016). Change in the behavioral phenotype of adolescents and adults with FXS: Role of the family environment. *Journal of Autism and Developmental Disorders, 46*(5), 1824–1833.

Stavropoulos, K. K., Viktorinova, M., Naples, A., Foss-Feig, J., & McPartland, J. C. (2018). Autistic traits modulate conscious and nonconscious face perception. *Social Neuroscience, 13*(1), 40–51.

Swartz, J. R., Wiggins, J. L., Carrasco, M., Lord, C., & Monk, C. S. (2013). Amygdala habituation and prefrontal functional connectivity in youth with autism spectrum disorders. *Journal of the American Academy of Child & Adolescent Psychiatry, 52*(1), 84–93.

Symons, F. J., Clark, R. D., Hatton, D. D., Skinner, M., & Bailey, D. B. (2003). Self-injurious behavior in young boys with fragile X syndrome. *American Journal of Medical Genetics Part A, 118*(2), 115–121.

Talisa, V. B., Boyle, L., Crafa, D., & Kaufmann, W. E. (2014). Autism and anxiety in males with fragile X syndrome: An exploratory analysis of neurobehavioral profiles from a parent survey. *American Journal of Medical Genetics Part A, 164*(5), 1198–1203.

Tassone, F., Greco, C. M., Hunsaker, M. R., Seritan, A. L., Berman, R. F., Gane, L. W., … Hagerman, R. J. (2012). Neuropathological, clinical and molecular pathology in female fragile X premutation carriers with and without FXTAS. *Genes, Brain and Behavior, 11*(5), 577–585.

van Lieshout, C. F., De Meyer, R. E., Curfs, L. M., & Fryns, J. P. (1998). Family contexts, parental behaviour, and personality profiles of children and adolescents with Prader-Willi, fragile-X, or Williams syndrome. *The Journal of Child Psychology and Psychiatry and Allied Disciplines, 39*(5), 699–710.

Webb, S. J., Dawson, G., Bernier, R., & Panagiotides, H. (2006). ERP evidence of atypical face processing in young children with autism. *Journal of Autism and Developmental Disorders, 36*(7), 881.

Weiss, J. A., Thomson, K., & Chan, L. (2014). A systematic literature review of emotion regulation measurement in individuals with autism spectrum disorder. *Autism Research, 7*(6), 629–648.

White, S. W., Oswald, D., Ollendick, T., & Scahill, L. (2009). Anxiety in children and adolescents with autism spectrum disorders. *Clinical Psychology Review, 29*(3), 216–229.

White, S. W., Mazefsky, C. A., Dichter, G. S., Chiu, P. H., Richey, J. A., & Ollendick, T. H. (2014). Social-cognitive, physiological, and neural mechanisms underlying emotion regulation impairments: Understanding anxiety in autism spectrum disorder. *International Journal of Developmental Neuroscience, 39*, 22–36.

Williams, J. H., Whiten, A., Suddendorf, T., & Perrett, D. I. (2001). Imitation, mirror neurons and autism. *Neuroscience & Biobehavioral Reviews, 25*(4), 287–295.

Williams, K. R., Wishart, J. G., Pitcairn, T. K., & Willis, D. S. (2005). Emotion recognition by children with down syndrome: Investigation of specific impairments and error patterns. *American Journal on Mental Retardation, 110*(5), 378–392.

Wimpory, D., Hobson, R. P., Williams, J. M. G., & Nash, S. (2000). Are infants with autism socially engaged? A study of recent retrospective parental reports. *Journal of Autism and Developmental Disorders, 30*, 525–536. https://doi.org/10.1023/A:1005683209438

Wiseman, F. K., Al-Janabi, T., Hardy, J., Karmiloff-Smith, A., Nizetic, D., Tybulewicz, V. L. J., … Strydom, A. (2015). A genetic cause of Alzheimer disease: Mechanistic insights from down syndrome. *Nature Reviews Neuroscience., 16*, 564. https://doi.org/10.1038/nrn3983

Zantinge, G., van Rijn, S., Stockmann, L., & Swaab, H. (2017). Physiological arousal and emotion regulation strategies in young children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 47*(9), 2648–2657.

Maltreatment and Emotional Development

Madeline B. Harms, Brian T. Leitzke, and Seth D. Pollak

Abstract

The family environment has strong impacts on children's emotional development. Although children can adapt to a high degree of variation in the type of input they receive, child maltreatment is a species-atypical experience that disrupts the biological systems that underlie children's social and emotional development. In this chapter we describe the consequences of maltreatment on children's emotional development, focusing on alterations in (1) emotion perception, recognition, and attention, (2) emotion expression, (3) regulation of negative emotions and stress, and (4) reward processing. We consider several target mechanisms through which child maltreatment impacts these aspects of emotion processing, including behavioral, physiological, cognitive, and neurobiological pathways. We also discuss clinical implications of this body of research, including the potential for designing effective interventions aimed at targeting specific emotional biases associated with the experience of maltreatment.

Child maltreatment is a widespread problem throughout the world. The Center for Disease Control (CDC) defines child maltreatment as "any act or series of acts of commission or omission by a parent or other caregiver that results in harm, potential for harm, or threat of harm to a child" (Leeb, Paulozzi, Melanson, Simon, & Arias, 2008). Researchers who study the impact and outcomes of child maltreatment typically discuss child maltreatment in terms of acts of commission and acts of omission (Pollak, Cicchetti, Hornung, & Reed, 2000). Acts of commission include physical, sexual, and psychological or emotional abuse, while acts of omission include failures to provide for and supervise children (e.g., neglect and exposure to violent environments).

Subtypes of maltreatment have similarly been categorized in terms of the presence of harmful input (abuse/trauma) or inadequate input (neglect/deprivation; Humphreys & Zeanah, 2015). Subtypes of maltreatment are difficult to examine separately because children who are maltreated frequently experience more than one type of abuse (Vachon, Krueger, Rogosch, & Cicchetti, 2015). Though there is some preliminary evidence that these subtypes of maltreatment may be associated with different emotional problems, current scientific understanding of these differential pathways is limited. Consequently, in this chapter, we discuss maltreatment as a broad construct composed of these subtypes (acts of

M. B. Harms (✉) · B. T. Leitzke · S. D. Pollak
University of Wisconsin—Madison, Department of Psychology, Madison, WI, USA

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_28

commission/harmful input and acts of omission/inadequate input), and we review research that focuses on one or more of these different components of maltreatment.

Childhood maltreatment is associated with a number of problems related to emotional development, defined as the development of emotion perception, communication, interpretation, and regulation of emotion (Halberstadt, Denham, & Dunsmore, 2002). Abnormal development of these processes can lead to behavioral problems and psychopathology, such as post-traumatic stress disorder (PTSD), conduct disorder, drug addiction, delinquency, incarceration, and depression (Humphreys & Zeanah, 2015; Cicchetti & Ng, 2014). Critically, many of these outcomes do not become apparent until long after maltreatment has ended. This pattern suggests that childhood maltreatment might initially alter certain developmental mechanisms, such as emotion processing or response to reward and punishment, which then lead to cascading effects as development progresses. This chapter will focus on alterations in potential mechanisms of emotional development stemming from childhood maltreatment that may lead to a broad spectrum of health and behavioral problems.

Emotional Problems Related to Child Maltreatment

Childhood maltreatment is reliably associated with a broad range of negative outcomes that may stem from problems with emotion processing. For example, maltreatment is equally likely to be associated with internalizing problems like depression and anxiety symptoms, and with externalizing problems such as anger and aggressive behavior (Springer, Sheridan, Kuo, & Carnes, 2007). Children who were maltreated also experience poorer peer relationships (Kim & Cicchetti, 2010). This broad range of outcomes linked to maltreatment exemplifies the concept of multifinality, that similar childhood experiences can facilitate different developmental pathways due to bidirectional interactions between a child and his/her environment (Cicchetti & Doyle, 2016). However, these diverse outcomes may share common underlying mechanisms related to emotion processing. For example, maltreated children tend to show an atypical trajectory of facial emotion recognition development, which is most apparent for expressions of anger. Relative to non-maltreated children, these children have heightened perceptual and physiological sensitivity to angry facial expressions (Pollak & Sinha, 2002; Shackman & Pollak, 2014), and are more likely to perceive emotional situations as demonstrating anger as early as preschool age (Pollak et al., 2000). Studies of maltreated children also show less accurate identification of facial emotions in general (da Silva Ferreira, Crippa, & de Lima Osório, 2014; Pollak et al., 2000) and particular difficulty identifying positive emotions (Koizumi & Takagish, 2014). In addition, these children show abnormalities in the expression and regulation of emotions (Kim-Spoon, Cicchetti, & Rogosch, 2013). For example, physically abused children show difficulty in interpreting emotional cues, greater tendencies to respond aggressively to conflict (Teisl & Cicchetti, 2007), and they more commonly show contextually inappropriate expressions of emotion (Shields & Cichetti, 1998). Another study found that 7–10-year-old physically abused boys show more aggressive behavior and negative affect than non-abused boys, and these behaviors appear to be mediated by heightened allocation of attention to angry faces (Shackman & Pollak, 2014). Maltreated children also show higher levels of rumination (repeatedly dwelling on past negative experiences), which has been associated with an attention bias to sad faces (Romens & Pollak, 2011) and may contribute to risk for depressive symptomatology. The combination of difficulties with emotional recognition, expression, and regulation may increase children's risk for a broad range of maladaptive outcomes. For example, misreading others' facial emotion might impair peer interactions, while problematic emotion regulation and expression may contribute to rumination and/or aggressive behavior.

There are several characteristics of maltreating families that distinguish them from typical family environments and create an atypical

emotional environment for children. First, children in maltreating families that are physically abusive experience physical harm and threat from their caregivers (Bick & Nelson, 2016; Pollak, 2015). This is in contrast to a supportive family environment, in which caregivers provide protection from physical harm. In neglectful families, caregivers fail to meet children's basic physical needs with respect to clothing, hygiene, food, and/or safety (Leeb et al., 2008). As a result, both neglect and abuse result in a high degree of environmental uncertainty for children: in abusive families it is difficult for a child to predict how a caregiver will react to his/her behavior, and in neglecting families, a child may not know when s/he will have food to eat or when a caregiver will be in the home. Children in maltreating families may also experience a non-normative emotional learning environment. Parents in these families often provide poor emotional signaling to their children, producing unclear facial and vocal expressions of emotion. For example, Shackman et al. (2010) found that abusive mothers produced less prototypical facial expressions of anger (i.e., less pronounced brow lowering and contracting) relative to non-abusive mothers. In addition, abusive mothers produced less prototypical vocal expressions of anger, happiness, and sadness, showing less affect and less variability between emotions than non-abusive mothers. These findings suggest that, while these parents may often be experiencing high levels of emotion, they do not convey their feelings in ways that are readily discernable or reliably predictive for their children.

These characteristics of maltreating families create pathways that lead to disturbances in children's perception, expression, and regulation of emotions. The physical harm and threat that maltreated children are exposed to results in chronic stress, which may lead to heightened anxiety, vigilance for threat, and stress dysregulation (Norman, Byambaa, Butchart, & Vos, 2012). Unclear emotional signaling from caregivers may impair children's developing abilities to recognize and respond appropriately to the emotions of others (Kim & Cicchetti, 2010). Finally, adverse childhood experiences such as maltreatment appear to be a form of "toxic stress" (McEwen & Seeman, 1999) that derails healthy brain development, impacting the structural and functional development of brain regions associated with attention, emotional control, and reward learning (Hart & Rubia, 2012; Heleniak, Jenness, Vander Stoep, McCauley, & McLaughlin, 2015). Altered development of these regions is likely to impact many aspects of emotional development including (1) emotion perception, recognition, and attention, (2) emotion expression, (3) regulation of negative emotions and stress, and (4) reward processing. Although most research to date has focused on the processing of negative emotions in the context of maltreatment, more recent research indicates that maltreatment may also alter reward processing and positive emotions. We focus on alterations in the four processes listed above and their associated neurobiology as potential mechanisms that link maltreatment to mental health and behavior problems. We also discuss the potential for interventions and therapies that target these mechanisms.

Emotion Perception, Recognition, and Attentional Processes

When identifying emotional expressions in others, children who have experienced maltreatment tend to differ from children raised in typical family environments. These atypical patterns of emotion recognition have implications for maltreated children's social development: emotion understanding and recognition in young children has been associated with quality of friendships, prosocial behavior, peer acceptance, and social skills later in childhood (Cutting & Dunn, 1999; Izard et al., 2016; Mostow, Izard, Fine, & Trentacosta, 2008). Therefore, maltreated children's atypical emotion perception and recognition patterns may partially explain their difficulties with peer relationships.

Different types of maltreatment have been associated with specific abnormalities in emotion perception and recognition. For example, children who were neglected, but not physically abused, show more difficulty in recognizing

emotional expressions, perceiving fewer distinctions between emotions than either physically abused children or non-maltreated children (Pollak et al., 2000). This evidence suggests that neglected children show generalized emotion recognition deficits, possibly because parents in these families tend to express a more restricted range of emotions to their children, providing fewer opportunities for children to learn to associate emotional expressions with environmental events. If caregivers' emotional expressions do not reliably predict subsequent events, neglected children might begin to attend to others' emotional expressions less than typically developing children, hindering their ability to accurately recognize emotions. Physically abused children, in contrast, do not show generalized difficulties in emotion recognition. Rather, they identify anger more readily than neglected or non-maltreated children (Ardizzi et al., 2015; Briggs-Gowan et al., 2015; Cicchetti & Curtis, 2005; Curtis & Cicchetti, 2011; da Silva Ferreira et al., 2014; Gibb, McGeary, & Beevers, 2015; Pollak, Vardi, Putzer Bechner, & Curtin, 2005; Shackman & Pollak, 2014; Shackman, Shackman, & Pollak, 2007). This tendency to readily and quickly recognize cues of anger and hostility is likely due to emotional attention processes that have been shaped by living in a threatening family environment.

Emotional Attention Processes

Children are exposed to an array of emotional cues and learn to direct their attention to salient and meaningful information in their environment. In an abusive family, it becomes particularly important for a child to attend to cues of anger that may indicate a threat to their well-being. This type of attention to threat cues in the environment subsequently affects the way children come to construe their social worlds. As an illustration, one study found that 5-year-old abused children tended to believe that almost any kind of interpersonal situation could result in an adult becoming angry. In contrast, most non-abused children saw anger as likely to result only from particular interpersonal circumstances (Perlman, Kalish, & Pollak, 2008). Children who suffered physical abuse are also more likely to view others as hostile and the world as generally unsafe (Gibb, 2002; Keil & Price, 2009). These biases influence information processing, with physically abused children incorrectly encoding social cues and exhibiting hostile attributional biases (Teisl & Cicchetti, 2007). Although these attentional processes reflect short-term adaptation to hostile environments, they carry long-term risk for health and behavior, contributing to problems such as aggressive behavior, depression, and anxiety.

One aspect of abused children's sensitivity to cues of anger and hostility is that they more readily identify emotional facial expressions as angry than non-maltreated children, a bias which may contribute to aggressive behavior. A series of studies demonstrate attentional biases toward angry expressions among abused children between preschool and middle childhood. For example, physically abused children more readily categorize faces that are morphed between two different emotions as angry (Pollak & Kistler, 2002) and require less perceptual information to identify faces as angry than non-maltreated children (Pollak & Sinha, 2002). Physically abused children also show biases to angry faces during cognitive tasks. They respond more quickly to angry faces during a Go/No-go paradigm (Pollak et al., 2000) and seem to require greater cognitive resources to disengage their attention from angry faces, showing delayed disengagement when angry faces served as invalid cues in a selective attention paradigm (Pollak & Tolley-Schell, 2003).

Shackman and Pollak (2014) examined individual differences in maltreated and non-maltreated children's attention to angry faces, along with negative affect and aggression after experiencing an acute, laboratory stressor. Physically abused children showed greater negative affect after the stressor, and these negative emotions were associated with greater aggressive behavior toward children's peers. However, this association was only present among children who exhibited greater attention to angry faces.

These findings demonstrate the impact of child maltreatment on emotional attention that influences children's regulation of emotion and aggression.

Heightened attention to angry faces in abused children likely reflects vigilance for threat in the environment, and therefore may also be related to the development of anxiety disorders. Heightened vigilance to threat has been associated with anxiety disorders in children and adolescents (Krain Roy et al., 2008), suggesting that such vigilance may be a mediating factor between maltreatment and anxiety-related psychopathology. Curiously though, PTSD, one type of anxiety disorder resulting from maltreatment, has been linked to attentional biases *away* from angry faces during a dot probe task (Pine et al., 2005). In this case, the different task format (quickly identifying the location of a dot versus explicitly identifying an emotion) may explain the difference in findings from studies that found heightened attention toward angry faces during emotion identification. Another possibility is that maltreatment initially heightens vigilance to angry faces, but over time severely maltreated children might develop automatic tendencies to avoid angry faces, resulting in an attention bias away from threat (Krain Roy et al., 2008). What does seem clear is that individuals who experienced child maltreatment show abnormal attentional processes associated with angry expressions, which may contribute to anxiety problems.

Maltreatment-related emotional attention biases may also contribute to the development of internalizing problems such as depression. One study reported that maltreated children showed attentional biases to sad faces under certain conditions: Children who experienced high levels of maltreatment showed biased attention toward sad faces following the initiation of a sad emotional state, while maltreated children with high levels of trait rumination exhibited biased attention toward sad faces during both sad and neutral states (Romens & Pollak, 2011). The phenomenon of rumination—a maladaptive emotion regulation strategy that involves passively and repetitively dwelling on and questioning negative feelings in response to distress—is a known risk factor for the development of psychopathology, particularly depression (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). These cognitive patterns may identify which maltreated children are most likely to exhibit biased attention for sad cues and be at heightened risk for depression. In addition, this study illustrates how two aspects of emotion processing—emotion regulation and emotional attention biases—can interact to increase maltreated children's risk for mental health problems.

Neural Bases of Emotional Attention

There is also support for alterations in regions of the brain associated with both attentional processes and emotional regulation as a result of maltreatment. The amygdala is involved in the rapid detection and response to emotionally salient events, particularly those that signal threat (Tamietto & deGelder, 2010). While the amygdala likely plays an important role in the vigilance toward anger and hostility observed in maltreated children, this is not the amygdala's only role. In addition to modulation by the frontal cortex (e.g., during emotion regulation), there is strong evidence that the amygdala coordinates the function of cortical networks when an organism evaluates the biological significance of affective information (for review, see Pessoa & Adolphs, 2010). In this way, the amygdala may influence higher-level cortical processing of emotional events, indicating that it can influence attention and appraisal of information both early and late in the processing stream.

In some, but not all, maltreated samples, the amygdala region shows abnormal development. For example, Heleniak et al. (2015) completed rigorous hand tracing of the amygdala in samples of children who experienced different forms of early stress including physical abuse, early neglect, or extreme family poverty. They found smaller amygdala volumes for children exposed to these different forms of stress. Furthermore, amygdala volumes were associated with both greater cumulative stress exposure and a higher prevalence of

child behavioral problems (Heleniak et al. 2015). These data suggest that early and severe life stress may be associated with increased excitation and cell death, reflected in reductions in gray matter volume. Although smaller, the amygdala may become overactive in maltreated children, who tend to show a heightened response in the amygdala during emotion processing tasks (Dannlowski et al., 2012; McCrory et al., 2010, 2012; McLaughlin, Peverill, Gold, Alves, & Sheridan, 2015; van Harmelen et al., 2013). Structural and functional alterations in the amygdala may help us understand individual differences in risk and resilience to behavioral problems as related to early life stress.

Interventions Targeting Emotional Attention

These emotional attention disturbances in maltreated children may also hold promise as targets for intervention. One example is the proliferation of attention bias modification paradigms that have been used to alter emotional attention biases associated with psychopathology (Shechner et al., 2011). Effective behavioral methods have been developed to ameliorate symptoms in a range of mental health problems including anxiety (Amir, Beard, Burns, & Bomyea, 2009), depression (Beevers, Clasen, Enoch, & Schnyer, 2015), phobias (Amir, Taylor, & Donohue, 2011), disordered eating (Renwick, Campbell, & Schmidt, 2013), and substance abuse (Field, Duka, Tyler, & Schoenmakers, 2009). Existing interventions that target attentional processes have most commonly been designed to reduce or modify maladaptive attention toward disorder-relevant stimuli (e.g., threat; Mogg, Waters, & Bradley, 2017). A number of training programs have been developed, with the most common being a modified version of the visual probe, or "Dot Probe" task (MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002), which promotes threat avoidance (e.g., Amir et al., 2009).

The modified visual probe task is based on research implicating preferential attention toward certain stimuli as a contributing factor in the development and maintenance of behavioral and mental health difficulties (Shechner & Bar-Haim, 2016). This task was designed to promote avoidance of threat-related cues by requiring participants to respond to a probe that appears behind a neutral stimulus a greater proportion of time than a targeted, threat-related stimulus. This training paradigm allows participants to learn the probable location of the probe and thus where to attend to improve their performance. In this way, participants learn to preferentially attend away from target cues in favor of the reinforced neutral cues (Bar-Haim, 2010). Such training programs have demonstrated alterations in attentional biases as well as reductions in various psychological symptoms (Beevers et al., 2015; Linetzky, Pergamin-Hight, Pine, & Bar-Haim, 2015; Mogoaşe, David, & Koster, 2014; Pergamin-Hight, Naim, Bakermans-Kranenburg, Van Ijzendoorn, & Bar-Haim, 2015; Shechner & Bar-Haim, 2016).

An alternative training program, interpretation bias training, was designed to improve the ability to discriminate between different emotions (Penton-Voak, Bate, Lewis, & Munafo, 2012). In this task, participants view single facial expressions of emotion morphed from one high intensity emotion to another (e.g., anger to happiness) and then attempt to identify what emotion is being expressed. To improve discriminability, participants receive corrective feedback during the training portion of the task. Such training is designed to alter individuals' interpretation of ambiguous faces to be more positive and less threatening (Penton-Voak et al., 2012; Penton-Voak et al., 2013; Stoddard et al., 2016). This paradigm has yielded shifts in maladaptive attentional tendencies as well as improvements in problematic symptomatology, including aggression and irritability in adolescent samples (Penton-Voak et al., 2012; Stoddard et al., 2016).

While not geared toward the specific deficits associated with a history of maltreatment, these advances suggest that similar types of approaches—if appropriately tailored—may also help address the threat biases and concomitant behavioral problems among maltreated children.

Promoting avoidance of threat, such as in the modified visual probe task, may in fact prove maladaptive for maltreated children, as the ability to quickly identify threat in a potentially dangerous situation allows for a possible escape from harm. However, improving children's ability to more accurately recognize certain emotional cues, such as anger, may prove adaptive if generalized to more social, non-threatening environments. A training program that improved accuracy in recognizing emotional cues may have the added benefit of maintaining the ability to recognize threat in settings where such cues are indicative of probable harm. Furthermore, interventions that successfully reduce maltreated children's hypervigilance to threat and hostility in others may reduce these children's own experience and expression of negative emotions.

Emotional Expression

The unpredictable and disorganized qualities that are associated with maltreating families—including unclear emotional signaling and inconsistent reactions to children's behavior—are likely to alter children's experience and expression of emotions, in addition to their emotion recognition and perception. In contrast to emotion perception and recognition, little is known about the extent to which abuse versus neglect exerts differential influences on children's emotional expression; most research to date on this topic involves children who were physically abused or who experienced a combination of abuse and neglect. Children living in these environments are likely to experience frequent negative emotions, including anger, frustration, and irritability (Shields & Cicchetti, 1998). Indeed, maltreated children show higher levels of negative emotionality than non-maltreated children particularly in terms of anger reactivity (Gunnar & Donzella, 2002). In addition to a preponderance of negative emotions, these children may be vulnerable to overwhelming emotional arousal. Such chronically heightened arousal may lead to difficulties managing and regulating intense emotions such as anger (Cummings, Hennessy, Rabideau, & Cicchetti, 1994). The proclivity to experience intense negative emotions combined with high emotional arousal may explain the tendencies of maltreated children to experience anger and behave aggressively in challenging social situations.

One aspect of emotional expression that has been studied in the context of child maltreatment is emotion lability/negativity, described as children's speed in reacting to affective stimuli and difficulty in recovering from negative emotional reactions (Dunsmore, Booker, & Ollendick, 2013). As an illustration, a child with high emotion lability/negativity may be prone to angry outbursts or exhibit dramatic mood swings. A longitudinal study of maltreated and non-maltreated children (Kim-Spoon et al., 2013) showed that maltreatment predicted higher emotion lability/negativity. Furthermore, lower levels of emotion regulation and higher levels of emotion lability/negativity were independently associated with increases in internalizing symptomatology between eight and nine years of age. In addition, emotion regulation mediated the longitudinal link between emotion lability/negativity and change in internalizing symptomatology among both groups of children: those with high emotion lability/negativity showed poor emotion regulation in the following year, which in turn predicted an increase in internalizing symptomatology. This study suggests that high emotion lability/negativity might interfere with the development of effective emotion regulatory strategies.

In a maltreating environment, children's heightened frequency and intensity of negative emotions likely requires greater emotion regulation capacity to manage. At the same time, Kim-Spoon et al. (2013) report that maltreatment appears to derail children's development of emotion regulation skills. Thus, a maltreated child is likely to experience intense negative emotions *and* to lack the skills and strategies need to regulate them in the service of goal-directed behavior. Insufficient regulation and management of emotions may lead to circumstances in which children are frequently overwhelmed by negative emotions, and in turn

contribute to the development of internalizing symptomatology (Calkins & Fox, 2002; Cicchetti & Toth, 1998). These interactions between emotional reactivity/expression and emotion regulation are an important potential mechanism underlying the development of internalizing disorders in maltreated children.

Emotion Regulation

Problems with emotion regulation are some of the most commonly noted sequelae of childhood maltreatment. Emotion regulation refers to an individual's ability to modify his/her own emotional arousal in order to maintain an optimal level of engagement with the environment (Thompson, 1994). Thus, emotion regulation is intertwined with emotional reactivity, and these two constructs are often difficult to disentangle. Emotion regulation allows children to respond in flexible and socially appropriate ways to changing demands in the environment (e.g., it may be acceptable to express dismay with a disappointing gift in some circumstances, but typically not when in the presence of the gift giver). Poor emotion regulation abilities are reflected in a broad range of negative outcomes, including internalizing problems (Kim & Cicchetti, 2010), externalizing problems (Herts, McLaughlin, & Hatzenbuehler, 2012), and peer rejection (Hanish et al., 2004). All of these problems are more prevalent in maltreated children relative to the general population, and are associated with psychopathological problems including depression, anxiety, and conduct disorder.

There is strong evidence that emotion regulation mediates links between maltreatment and later mental health and behavior problems. For example, one study found that young adults who experienced maltreatment as children showed higher levels of ADHD symptoms than non-maltreated individuals. However, this relation was mediated by individual differences in coping self-efficacy, an aspect of emotion regulation defined as the belief that one can effectively utilize coping behaviors in stressful situations. Maltreated individuals with high coping self-efficacy showed lower ADHD symptoms than those with low coping self-efficacy (Singer, Humphreys, & Lee, 2016). In addition, in a longitudinal study of over 400 children 6–12 years of age, Kim and Cicchetti (2010) found that neglect, physical abuse, and sexual abuse all predicted emotion dysregulation in early childhood, which in turn predicted peer rejection and externalizing symptoms in later childhood. These studies raise the possibility that diminished emotion regulation resulting from childhood maltreatment may lead to a cascade of social problems that ultimately result in increased risk for psychopathology and behavioral problems.

There is also evidence that the timing of maltreatment influences relationships between emotion regulation and subsequent mental health problems. Emotion regulation may be a stronger predictor of subsequent internalizing symptomatology in early childhood than in later childhood because younger children have not yet developed the cognitive and social skills that help older children cope with stress (Cole, Luby, & Sullivan, 2008). For the same reason, younger children, who are just beginning to develop abilities to regulate their emotions, may be more vulnerable to environmental stress such as maltreatment. Maltreatment in early childhood may both hinder the emergence of emotion regulation skills (Kim-Spoon et al., 2013), and in turn prevent the development of higher-level executive function capacities that build upon this initial regulatory capacity. This notion may explain why maltreatment occurring in early childhood appears to exert more deleterious effects on mental health and social adjustment than maltreatment that is confined to later childhood or adolescence (Pechtel & Pizzagalli, 2011).

Neural Bases for Emotion Regulation

Emotion regulation is dependent on the prefrontal cortex (PFC) and its connections with limbic brain regions involved in emotional reactivity. During emotional events, an optimally functioning PFC can modulate the activity of limbic brain regions to keep emotional reactivity at an appro-

priate level. For example, when individuals are instructed to regulate negative emotions using cognitive reappraisal, PFC activity reduces negative emotion by increasing activity in limbic regions involved in the generation of positive emotions (i.e., ventral striatum/nucleus accumbens) and decreasing activity in regions involved in generating negative emotions (i.e., amygdala). The modulation of these systems implicated in affective appraisal and learning processes in turn impacts individuals' emotional experience (Wager et al., 2008). The PFC is significantly impacted by childhood maltreatment and other forms of early adversity (Hart & Rubia, 2012), likely because it contains a high density of glucocorticoid receptors; therefore, chronically high levels of stress hormones disproportionately interfere with the growth and development of the PFC (Joëls et al., 2007; Dias-Ferreira et al., 2009). Smaller PFC gray matter volumes are commonly observed in individuals exposed to childhood maltreatment (Gorka, Hanson, Radtke, & Hariri, 2014; Hanson et al., 2010). Although links between brain structure and function are not always straightforward, a reduction in the number of PFC neurons and/or dendrites might impair the PFC's ability to regulate the activity of limbic brain regions. Supporting this notion, childhood maltreatment is also associated with weakened functional connectivity between the ventral PFC and subcortical regions such as the amygdala and hippocampus. This reduced connectivity may play a role in fear regulation and contribute to the development of PTSD (Birn, Patriat, Phillips, Germain, & Herringa, 2014). Another recent study found that childhood maltreatment was associated with reduced structural integrity of the uncinate fasciculus (UF) in young adults, a major white matter tract that links the ventromedial PFC to the amygdala (Heleniak et al., 2015). Structural integrity of the UF also mediated the relationship between childhood maltreatment and internalizing symptoms assessed at a later time point, with lower UF integrity predicting higher internalizing symptoms. This relation suggests a potential causal link between a neural pathway involved in emotion regulation and mental health.

Abnormal growth and development of brain regions that regulate stress and negative emotions may influence subsequent mental health by hindering the ability to regulate stress responses to later events. If an individual cannot efficiently regulate their emotions during stressful situations, those stressors are more likely to adversely affect their psychological functioning. Supporting this idea, Hanson et al. (2015) found that the link between UF integrity and internalizing problems was most pronounced in individuals who experienced additional stressful events between their initial scan and later psychological assessment. Individuals who had greater stress exposure over the course of the study showed a stronger negative correlation between UF integrity and internalizing symptoms. Another study (Gorka et al., 2014) found that reduced gray matter volume in the hippocampus and medial prefrontal cortex regions mediated the association between self-reported childhood maltreatment and trait anxiety in adulthood and predicted the association between anxiety symptoms and stressful life events in the subsequent year. These results suggest that reduced volume in these regions is associated with higher susceptibility to future stressful events.

Hormonal Regulation of Emotions and Stress

Additional evidence that increased biological and psychological reactivity to later life stressors could mediate links between childhood maltreatment and mental health outcomes comes from studies examining the regulation of stress by the hypothalamic-pituitary-adrenal (HPA) axis. This system also plays an important role in emotion regulation. When an individual encounters a stressor, corticotropin-releasing hormone (CRH) is secreted from the hypothalamus. This hormone acts on the pituitary gland, causing it to release adrenocorticotropic hormone (ACTH). ACTH then acts upon the adrenal gland, resulting in the production of cortisol. Cortisol binds with glucocorticoid (GR) receptors in the hippocampus to regulate the HPA axis and inhibit further release

of CRH. Similarly, cortisol released in response to stress binds with GR receptors at the cellular level to regulate the immune system (Lupien, McEwen, Gunnar, & Heim, 2009).

The HPA axis promotes adaptation in response to normative stressors. However, extreme levels of early life stress exposure, such as severe maltreatment, may impair biological regulation of stress hormones, as well as general health and immune functioning (Koss, Hostinar, Donzella, & Gunnar, 2014). For example, in typically developing individuals, cortisol release follows a diurnal rhythm with higher levels in the morning and lower levels in the evening. However, this diurnal pattern may be altered in children exposed to severe early life stress. A recent meta-analysis showed that maltreatment was strongly associated with lower awakening cortisol levels (Bernard, Frost, Bennet, & Lindhiem, 2017). In addition, a review of 20 studies examining stress and adult immune function found that child maltreatment was reliably associated with higher levels of circulating inflammatory proteins in adulthood (Coelho et al., 2014) pointing to long-term health effects of this type of chronic stress.

Altered functioning of HPA systems may help to explain relationships between child maltreatment and behavior problems. For example, one study found that children who had been abused and exhibited abnormal, flat diurnal cortisol rhythms tended to exhibit high levels of aggressive behaviors (Bernard, Zwerling, & Dozier, 2015). However, children with normal diurnal cortisol rhythms did not show increased aggressive behavior. These findings suggest a relation between maltreatment and dysregulated stress reactivity that may have implications for the development of emotion regulation. Along these lines, dysregulation in stress reactivity was found to mediate the relation between child maltreatment and the later emergence of externalizing behaviors in a longitudinal study spanning from middle to high school, with greater stress dysregulation predicting more externalizing problems (Heleniak et al., 2015). Causal influences between cortisol reactivity and emotion regulation may operate in both directions. Abnormal diurnal cortisol patterns may diminish children's ability to regulate their emotions, but emotion regulation can also influence the appraisal of stressful situations and halt or modulate the stress response (Stansbury & Gunnar, 1994).

Prevention and Intervention for Emotion Regulation Difficulties

In sum, maltreatment appears to disrupt the development of neurobiology that facilitates emotion regulation, which can contribute to both internalizing and externalizing problems later in development. However, emotion regulation is a promising target for therapy-based approaches to aid emotional development in victims of maltreatment. For example, trauma-focused cognitive behavior therapy is a treatment for traumatized children that provides individual and family therapy and includes parental or caregiver participation as a critical component (Cohen & Mannarino, 2015). Trauma-focused cognitive behavior therapy provides psychoeducation, targets emotion regulation and cognitive processing, and has strong empirical support for improving symptoms of anxiety, depression, and PTSD in addition to behavioral, cognitive, and relationship problems for both children and parents. Despite these promising developments, to fully address emotion-processing sequelae of maltreatment and prevent psychopathology, interventions that target positive emotions and reward, in addition to management of negative emotions, may be needed in light of recent evidence that maltreatment appears to disrupt reward processing.

Reward Processing

Most research to date has focused on how maltreated children perceive, recognize, and respond to negative emotions, given the preponderance of negative emotions to which these children are exposed. However, there is a growing scientific interest and awareness in the effects of early stressful environments on children's processing of positive emotional information in the form of

rewards. Rewards consist of positively valenced events or information that tend to elicit approach and/or consummatory behavior. As shown by animal and human research, rewards also facilitate learning, i.e. associating events or behaviors with rewarding or non-rewarding information (Schoenbaum & Roesch, 2005). After repeated associations involving reward, individuals learn to repeat actions that result in reward and cease actions that result in non-reward or punishment. In addition, rewards tend to induce positive emotions such as excitement and satisfaction (Berridge, Robinson, & Aldridge, 2009). Reward processing thus provides a useful window into understanding the multiple levels of impact that child maltreatment may have on emotional development.

Abnormal responsivity to rewarding information might help to explain several difficulties that have been noted in maltreated individuals. One commonly observed phenomenon is anhedonia, a lack of positive emotion that is thought to be an endophenotype of depression (Pizzagalli, 2014). Individuals with anhedonia may not take pleasure in stimuli or activities that are typically experienced as rewarding, such as food or social activities. Another problem that has been observed in maltreated adolescents and adults is difficulty learning from positive and negative feedback (Hanson et al., 2017: Harms, Shannon Bowen, Hanson, & Pollak, 2017; Pechtel & Pizzagalli, 2013). In probabilistic or instrumental learning tasks, abused individuals are slower to associate images with positive or negative feedback than non-maltreated children, as reflected in their accuracy in selecting the image that is associated with reward. Attention to and engagement with rewarding information is necessary both to take pleasure in rewards and to use rewards to guide future behavior. Hypo-responsivity to rewarding information might therefore explain why maltreatment is associated with both anhedonia and associative learning difficulties.

In contrast to *heightened* attention toward negative or threatening information exhibited by maltreated children, a growing body of evidence shows a relation between maltreatment and *reduced* reactivity to the anticipation and/or consumption of reward. Because reward processing in the context of maltreatment is a relatively new area of research, little is known about whether different forms of maltreatment are associated with different reward-related processes. Nevertheless, there is evidence that children exposed to various forms of maltreatment prioritize negative cues at the expense of positive cues. For example, when viewing emotional facial expressions, abused children identified as having attachment anxiety exhibit an attentional bias away from facial expressions depicting happiness (Davis et al., 2014). Consistent with this view, on a probabilistic reward task, maltreated children fail to show sensitivity to important environmental cues, such as changing rewards (Guyer et al., 2006; Mueller et al., 2012; Weller & Fisher, 2013). In contrast, non-maltreated children respond more quickly as their chances of winning a reward increase. Reports of primate behavior also suggest that maltreated monkeys display less interest in rewards relative to control monkeys (Pryce, Dettling, Spengler, Schnell, & Feldon, 2004). While these findings emphasize the importance of early experience in shaping responses to rewards, a greater understanding of the brain regions associated with learning reward or punishment is likely to help account for the effects of the environment on maltreated children's interpersonal behavior. Indeed, a few candidate brain systems have emerged as potentially underlying these phenomena and provide clues about the development of psychopathology.

Neural Mechanisms of Reward Processing

Rodent studies provided the first pieces of information regarding links between abnormal parenting behaviors and offspring's reward processing. For example, experimental disruption of reward circuitry in the brain prevents mice pups from emitting vocalizations when removed from their mothers; such a disturbance interferes with brain reward systems and also prevents mice from showing a preference for their own mothers (Moles, Kieffer, & D'Amato,

2004). This association also works in the opposite direction: when attachment to the parent is disrupted, other aspects of the animals' reward systems are affected. Animals with disrupted attachments to their parents also show abnormal responses to novelty, altered appetitive conditioning, and unusually high sensitivity to dopamine antagonists and reactivity to other drug administrations. This cluster of symptoms resembles anhedonia, which is a symptom of depression in humans (for review, see Bakermans-Kranenburg & Van Ijzendoorn, 2011; Matthews & Robbins, 2003).

The brain region most often associated with reward processing is the ventral striatum (VS), which is part of the basal ganglia, a diverse network of subcortical structures that work in concert to orchestrate and execute planned, motivated behaviors that require integration of movement, thinking, and feeling (Haber, 2003). Adolescents and adults exposed to childhood family adversity and maltreatment tend to show decreased VS response during reward anticipation (Boecker et al., 2014; Dillon et al., 2009; Hanson et al., 2016; Holz et al., 2017). Interestingly, these populations do not show blunted VS activity when they actually receive a reward, suggesting that these types of early adversity might particularly influence the ability to *learn* rewarding-predicting cues. Blunted VS activity during reward anticipation might also reflect deficits in approach behavior toward biologically relevant goals, which may result in less effort and motivation to obtain rewards (Holz et al., 2017). This pattern would have adverse effects for social functioning, which is dependent on the desire to obtain rewards such as social approval.

The anterior cingulate cortex (ACC) is another area of the frontal cortex implicated in reward learning. Computational models, single-unit recording in non-human animals, studies of human patients with brain damage, and basic cognitive neuroscience studies in typically developing humans all cohere in suggesting that the ACC plays a central role in how organisms make predictions and improve those predictions by processing prediction errors (Botvinick, Cohen, & Carter, 2004; Ridderinkhof, 2004; Schultz & Dickinson, 2000). Prediction errors are engines of learning because detecting differences in outcomes guides subsequent actions.

Neuronal loss and smaller volumes in the ACC have been reported in children who have suffered physical abuse compared to non-maltreated children (Carrion et al., 2009; De Bellis, Keshavan, Spencer, & Hall, 2000; Teicher, Anderson, Ohashi, & Polcari, 2014; Thomaes, Dorrepaal, & Draijer, 2010). Hanson and colleagues (Hanson et al., 2012) found that children who experienced high levels of early life stress had smaller volumes in the ACC and also more errors during an executive functioning task. In that study, individual differences in ACC volumes accounted for the association between levels of early life stress and the number of errors children made during the task. Research in non-human animals has also noted structural differences in the ACC, with lower dendritic branching in this area in rodents exposed to early stress (Gos, Bock, Poeggel, & Braun, 2008).

Functional brain imaging has also revealed that abused adolescents who showed lower ACC activation to reward trials during reversal learning performed more poorly on the task. This finding could reflect reduced cognitive engagement during rewarded trials in adolescents who had difficulty switching associations (Harms, Shannon-Bowen, Hanson, & Pollak, 2017). Similarly, resting-state functional connectivity points to effects of child maltreatment in the circuit level dynamics of the ACC related to abuse (Herringa, Birn, & Ruttle, 2013). Taken together, these findings are consistent with the possibility that children who have suffered from maltreatment experience problems related to associative learning processes. Reduced engagement and attention to reward as reflected in ACC activity may lead to reduced learning from reward. Such processes may lead to a cascade of developmental challenges because they are a major component of adaptive social learning. In this manner, learning difficulties may undermine children's attempts

to develop effective strategies to cope with changing environmental contingencies.

The orbitofrontal cortex (OFC) is another region that plays an important role in reward processing. The OFC is crucial for signaling and updating outcome expectancies such as reward/punishment to facilitate associative learning (Kringelbach & Rolls, 2004). This region also contributes to an organism's ability to flexibly adapt behavior in response to changing contingencies (Murray, O'Doherty, & Schoenbaum, 2007), in coordination with the basal ganglia (Frank & Claus, 2006). Interestingly, OFC neurons do not stop firing in response to a reward after learning, suggesting that these neurons support predictions on the basis of afferent input and anticipation prior to other emotion-processing regions such as the amygdala (Schoenbaum, Roesch, Stalnaker, & Takahashi, 2009). As expected, impairments in these systems are associated with poor learning from environmental cues.

Supporting the role of the OFC in reward learning, damage to the OFC causes deficits in reversal learning, reduces the speed of reward learning, and is activated in humans during processes such as regret and counterfactual reasoning (Honey, Kötter, & Breakspear, 2007; Passingham, Stephan, & Kötter, 2002). Common to these examples is the need to signal, in real-time, information about outcomes predicted by circumstances in the environment. Some emerging evidence also suggests functional changes in the OFC and BG during reward processing in adolescents (Galvan et al., 2006). This further suggests that these systems are a source of developmental changes in social behavior.

There is some inconsistency in the literature regarding the effects of maltreatment on the structure and function of the orbitofrontal cortex (OFC). There have been reports of both smaller volumes (Hanson et al., 2010; Holz et al., 2015; McCrory, De Brito, & Viding, 2012) and larger volumes (Carrion et al., 2009) in the OFC for children and adolescents who have suffered physical abuse. Inconsistencies have also been found in non-human animals, with both dendritic expansion (Liston et al., 2006) and retraction (Helmeke et al., 2009) reported in the OFC after chronic stress exposure. Functional brain imaging may help in clarifying the role of frontal lobe circuitry in developmental problems associated with maltreatment. However, functional abnormalities in the OFC have not consistently been identified among maltreated individuals. Although abnormal structure and function of the VS and ACC have been associated with maltreatment, links between maltreatment and abnormal reward processing might be a function of network-level and connectivity disturbances, rather than abnormal size or function of individual regions. This would not be surprising, given that reward pathways involve the complex coordination of many brain regions (Haber & Knutson, 2010).

There is evidence that functioning of these reward systems may account, in part, for how child maltreatment confers pervasive lifetime risks for children, but also confers the potential for resilience. As an illustration, hypoactive reward processing has repeatedly been demonstrated in depression (Pizzagalli, 2014; Russo & Nestler, 2013), and a substantial portion of depressed individuals have a history of maltreatment (Norman et al., 2012). This suggests that maltreatment may confer risk for depression via hypoactive reward processing. However, behavioral and neural reward reactivity during a monetary-incentive delay task has been shown to moderate the association of maltreatment with depression. Both faster reaction times to cues that predicted monetary reward and greater activation of the left pallidum, a region of the basal ganglia, were linked to lower symptoms of depression in maltreated adolescents (Dennison et al., 2016). Furthermore, higher levels of reward response predicted lower increases in depression over the next two years. This study suggests that higher reactivity to monetary reward is a potential marker of resilience to depression among adolescents exposed to maltreatment. Future interventions could capitalize on findings such as this one to develop treatments that increase attention to

and processing of reward cues in children exposed to maltreatment.

Conclusions and Future Directions

Although it has been clear for a number of years that maltreatment tends to result in disturbances in children's emotional development, the mechanisms that explain these processes are not fully understood. Here, we focused on emotion and stress regulation, the perception and expression of emotion, and reward processing as critical components linking child maltreatment to difficulties in emotion processing and development. Each of these mechanisms has been empirically shown to link child maltreatment to later mental health problems. However, there are undoubtedly additional mechanisms that will be uncovered by future research.

There are some outstanding limitations in the current literature that, if addressed, will greatly improve our understanding of the specific impacts of child maltreatment on emotional development. First, many studies still rely on self-report by adult subjects of past maltreatment. This approach may not accurately capture specific aspects of timing and chronicity of maltreatment, which are important factors in emotional development. For example, some studies indicate that children who were abused earlier and more chronically show more maladaptive emotional and cognitive processes (Cowell, Cicchetti, Rogosch, & Toth, 2015; Pechtel & Pizzagalli, 2011), and higher rates of anxiety and depression (Kaplow & Widom, 2007).

Studying the sequelae of child maltreatment is also complicated by the fact that many of the emotional manifestations of this early stress do not appear until much later in development, often adolescence or even adulthood. For example, adolescents in substance abuse treatment who were maltreated in early childhood are more likely to relapse than adolescents who were not maltreated, and relapse appears to be linked to maltreatment-related changes in limbic brain regions (Van Dam et al., 2014). Long-term alterations in limbic brain regions (Dannlowski et al., 2012) and HPA system function (Gunnar & Quevedo, 2008) due to maltreatment may also contribute to other problems that tend to emerge during adolescence, such as depression and PTSD. Adolescence may represent an especially vulnerable time for maltreated individuals due to changes in fronto-limbic connectivity patterns that occur during the pubertal transition (Ladouceur et al. 2012). Despite evidence of these sleeper effects, there are few longitudinal studies that identify maltreatment in childhood and observe emotional development in these individuals until adulthood. These types of studies are essential to understanding how maltreatment impacts emotion processing and how certain developmental mechanisms confer mental health risks over time. The few longitudinal studies that do exist suggest that maltreatment in infancy and/or early childhood may be associated with the most significant emotional and neurocognitive problems across development (Cowell et al., 2015; Kim-Spoon et al., 2013). Yet, psychopathologies such as depression, conduct disorder, and drug abuse are often not apparent until adolescence. Long-term longitudinal studies are thus essential to improve our understanding of links between maltreatment, emotional development, and mental health.

A final limitation in understanding the effects of child maltreatment on the development of emotion systems is that maltreatment history is likely to reflect the potential for broader stress and conflict in family relationships (Kim-Spoon et al., 2013). Factors in the family environment such as parenting behaviors, marital relationships, and communication of positive and negative emotion among family members also impact children's emotional development (Morris, Silk, Steinberg, Myers, & Robinson, 2007), and their effects may be difficult to tease apart from those of maltreatment. Thus, future research that examines the unique effects of these other aspects of the emotional climate within maltreating and non-maltreating families will benefit the field.

References

Amir, N., Beard, C., Burns, M., & Bomyea, J. (2009). Attention modification program in individuals with generalized anxiety disorder. *Journal of Abnormal Psychology, 118*(1), 28–33. https://doi.org/10.1037/a0012589

Amir, N., Taylor, C. T., & Donohue, M. C. (2011). Predictors of response to an attention modification program in generalized social phobia. *Journal of Consulting and Clinical Psychology, 79*(4), 533–541. https://doi.org/10.1037/a0023808

Ardizzi, M., Martini, F., Umiltà, M. A., Evangelista, V., Ravera, R., & Gallese, V. (2015). Impact of childhood maltreatment on the recognition of facial expressions of emotions. *PLoS One, 10*(10), e0141732–e0141719. https://doi.org/10.1371/journal.pone.0141732

Bakermans-Kranenburg, M. J., & Van Ijzendoorn, M. H. (2011). Differential susceptibility to rearing environment depending on dopamine-related genes: New evidence and a meta-analysis. *Development and Psychopathology, 23*(01), 39–52. https://doi.org/10.1017/S0954579410000635

Bar-Haim, Y. (2010). Research review: Attention bias modification (ABM): A novel treatment for anxiety disorders. *Journal of Child Psychology and Psychiatry, 51*(8), 859–870.

Beevers, C. G., Clasen, P. C., Enoch, P. M., & Schnyer, D. M. (2015). Attention bias modification for major depressive disorder: Effects on attention bias, resting state connectivity, and symptom change. *Journal of Abnormal Psychology, 124*(3), 463–475. https://doi.org/10.1037/abn0000049

Bernard, K., Zwerling, J., & Dozier, M. (2015). Effects of early adversity on young children's diurnal cortisol rhythms and externalizing behavior. *Developmental Psychobiology, 57*(8), 935–947. https://doi.org/10.1002/dev.21324

Bernard, K., Frost, A., Bennett, C. B., & Lindhiem, O. (2017). Maltreatment and diurnal cortisol regulation: A meta-analysis. *Psychoneuroendocrinology, 78*, 57–67.

Berridge, K., Robinson, T. E., & Aldridge, J. (2009). Dissecting components of reward: 'liking', 'wanting', and learning. *Current Opinion in Pharmacology, 9*, 65–73. https://doi.org/10.1016/j.coph.2008.12.014

Bick, J., & Nelson, C. A. (2016). Early adverse experiences and the developing brain. *Neuropsychopharmacology, 41*(1), 177–196. https://doi.org/10.1038/npp.2015.252

Birn, R. M., Patriat, R., Phillips, M. L., Germain, A., & Herringa, R. J. (2014). Childhood maltreatment and combat posttraumatic stress differentially predict fear-related fronto-subcortical connectivity. *Depression and Anxiety, 31*(10), 880–892. https://doi.org/10.1002/da.22291

Boecker, R., Holz, N. E., Buchmann, A. F., Blomeyer, D., Plichta, M. M., Wolf, I., … Antal, A. (2014). Impact of early life adversity on reward processing in young adults: EEG-fMRI results from a prospective study over 25 years. *PLoS One, 9*(8), e104185.

Botvinick, M. M., Cohen, J. D., & Carter, C. S. (2004). Conflict monitoring and anterior cingulate cortex: An update. *Trends in Cognitive Sciences, 8*(12), 539–546. https://doi.org/10.1016/j.tics.2004.10.003

Briggs-Gowan, M. J., Pollak, S. D., Grasso, D., Voss, J., Mian, N. D., Zobel, E., … Pine, D. S. (2015). Attention bias and anxiety in young children exposed to family violence. *Journal of Child Psychology and Psychiatry, 56*(11), 1194–1201. https://doi.org/10.1111/jcpp.12397

Calkins, S. D., & Fox, N. A. (2002). Self-regulatory processes in early personality development: A multilevel approach to the study of childhood social withdrawal and aggression. *Development and Psychopathology, 14*(3), 477–498.

Carrion, V. G., Weems, C. F., Watson, C., Eliez, S., Menon, V., & Reiss, A. L. (2009). Converging evidence for abnormalities of the prefrontal cortex and evaluation of midsagittal structures in pediatric posttraumatic stress disorder: An MRI study. *Psychiatry Research: Neuroimaging, 172*(3), 226–234. https://doi.org/10.1016/j.pscychresns.2008.07.008

Cicchetti, D., & Curtis, W. (2005). An event-related potential study of the processing of affective facial expressions in young children who experienced maltreatment during the first year of life. *Development and Psychopathology, 17*(03), 641–677. https://doi.org/10.1017/S0954579405050315

Cicchetti, D., & Rowena, N. (2014). *Emotional development in maltreated children*. https://doi.org/10.1159/000354349

Cicchetti, D., & Doyle, C. (2016). Child maltreatment, attachment and psychopathology: Mediating relations. *World Psychiatry, 15*(2), 89–90.

Cicchetti, D., & Toth, S. L. (1998). The development of depression in children and adolescents. *American Psychologist, 53*(2), 221–241.

Coelho, R., Viola, T. W., Walss-Bass, C., Brietzke, E., & Grassi-Oliveira, R. (2014). Childhood maltreatment and inflammatory markers: A systematic review. *Acta Psychiatrica Scandinavica, 129*(3), 180–192.

Cohen, J. A., & Mannarino, A. P. (2015). Trauma-focused cognitive behavior therapy for traumatized children and families. Child and Adolescent Psychiatric Clinics of North America, 24(3), 557–570. https://doi.org/10.1016/j.chc.2015.02.005

Cole, P. M., Luby, J., & Sullivan, M. W. (2008). Emotions and the development of childhood depression: Bridging the gap. *Child Development Perspectives, 2*(3), 141–148.

Cowell, R. A., Cicchetti, D., Rogosch, F. A., & Toth, S. L. (2015). Childhood maltreatment and its effect on neurocognitive functioning: Timing and chronicity matter. *Development and Psychopathology, 27*(02), 521–533. https://doi.org/10.1017/S0954579415000139

Cummings, E. M., Hennessy, K., Rabideau, G., & Cicchetti, D. (1994). Responses of physically abused boys to interadult anger involving their mothers. *Development and Psychopathology, 6*, 31–42. https://doi.org/10.1017/S0954579400005861

Cutting, A. L., & Dunn, J. (1999). Theory of mind, emotion understanding, language, and family background: Individual differences and interrelations. *Child Development, 70*(4), 853–865.

Curtis, W. J., & Cicchetti, D. (2011). Affective facial expression processing in young children who have experienced maltreatment during the first year of life: An event-related potential study. *Development and Psychopathology, 23*(02), 373–395. https://doi.org/10.1017/S0954579411000125

da Silva Ferreira, G. C., Crippa, J. A. S., & de Lima Osório, F. (2014). Facial emotion processing and recognition among maltreated children: A systematic literature review. *Frontiers in Psychology*, 5. https://doi.org/10.3389/fpsyg.2014.01460/abstract

Dannlowski, U., Stuhrmann, A., Beutelmann, V., Zwanzger, P., Lenzen, T., Grotegerd, D., … Kugel, H. (2012). Limbic scars: Long-term consequences of childhood maltreatment revealed by functional and structural magnetic resonance imaging. *Biological Psychiatry, 71*(4), 286–293.

Davis, J. S., Fani, N., Ressler, K., Jovanovic, T., Tone, E. B., & Bradley, B. (2014). Attachment anxiety moderates the relationship between childhood maltreatment and attention bias for emotion in adults. *Psychiatry Research, 217*(1–2), 79–85. https://doi.org/10.1016/j.psychres.2014.03.010

De Bellis, M. D., Keshavan, M. S., Spencer, S., & Hall, J. (2000). N-Acetylaspartate concentration in the anterior cingulate of maltreated children and adolescents with PTSD. *American Journal of Psychiatry, 157*(7), 1175–1177.

Dennison, M. J., Sheridan, M. A., Busso, D. S., Jenness, J. L., Peverill, M., Rosen, M. L., & Mclaughlin, K. A. (2016). Neurobehavioral markers of resilience to depression amongst adolescents exposed to child abuse. *Journal of Abnormal Psychology, 125*(8), 1201–1212. https://doi.org/10.1037/abn0000215

Dias-Ferreira, E., Sousa, J. C., Melo, I., Morgado, P., Mesquita, A. R., Cerqueira, J. J., … Sousa, N. (2009). Chronic stress causes frontostriatal reorganization and affects decision-making. *Science, 325*(5940), 621–625.

Dillon, D. G., Holmes, A. J., Birk, J. L., Brooks, N., Lyons-Ruth, K., & Pizzagalli, D. A. (2009). Childhood adversity is associated with left basal ganglia dysfunction during reward anticipation in adulthood. *Biological Psychiatry, 66*, 206–213.

Dunsmore, J. C., Booker, J. A., & Ollendick, T. H. (2013). Parental emotion coaching and child emotion regulation as protective factors for children with oppositional defiant disorder. *Social Development, 22*(3), 444–466.

Field, M., Duka, T., Tyler, E., & Schoenmakers, T. (2009). Attentional bias modification in tobacco smokers. *Nicotine & Tobacco Research, 11*(7), 812–822. https://doi.org/10.1093/ntr/ntp067

Frank, M. J., & Claus, E. D. (2006). Anatomy of a decision: Striato-orbitofrontal interactions in reinforcement learning, decision making, and reversal. *Psychological Review, 113*(2), 300–326. https://doi.org/10.1037/0033-295X.113.2.300

Galvan, A., Hare, T. A., Parra, C. E., Penn, J., Voss, H., Glover, G., & Casey, B. J. (2006). Earlier development of the accumbens relative to orbitofrontal cortex might underlie risk-taking behavior in adolescents. *The Journal of Neuroscience, 26*(25), 6885–6892. https://doi.org/10.1523/JNEUROSCI.1062-06.2006

Gibb, B. E. (2002). Childhood maltreatment and negative cognitive styles. *Clinical Psychology Review, 22*(2), 223–246. https://doi.org/10.1016/S0272-7358(01)00088-5

Gibb, B. E., McGeary, J. E., & Beevers, C. G. (2015). Attentional biases to emotional stimuli: Key components of the RDoC constructs of sustained threat and loss. *American Journal of Medical Genetics Part B: Neuropsychiatric Genetics, 171*(1), 65–80. https://doi.org/10.1002/ajmg.b.32383

Gorka, A. X., Hanson, J. L., Radtke, S. R., & Hariri, A. R. (2014). Reduced hippocampal and medial prefrontal gray matter mediate the association between reported childhood maltreatment and trait anxiety in adulthood and predict sensitivity to future life stress. *Biology of Mood and Anxiety Disorders, 4*, 12. https://doi.org/10.1186/2045-5380-4-12

Gos, T., Bock, J., Poeggel, G., & Braun, K. (2008). Stress-induced synaptic changes in the rat anterior cingulate cortex are dependent on endocrine developmental time windows. *Synapse, 62*(3), 229–232. https://doi.org/10.1002/syn.20477

Gunnar, M. R., & Donzella, B. (2002). Social regulation of the cortisol levels in early human development. *Psychoneuroendocrinology, 27*, 199–220. https://doi.org/10.1016/S0306-4530(01)00045-2

Gunnar, M., & Quevedo, K. (2008). Early care experiences and HPA axis regulation in children: A mechanism for later trauma vulnerability. *Progress in Brain Research, 167*, 137–149. https://doi.org/10.1016/S0079-6123(07)67010-1

Guyer, A. E., Kaufman, J., Hodgdon, H. B., Masten, C. L., Jazbec, S., Pine, D. S., & Ernst, M. (2006). Behavioral alterations in reward system function. *Journal of the American Academy of Child and Adolescent Psychiatry, 45*(9), 1059–1067. https://doi.org/10.1097/01.chi.0000227882.50404.11

Haber, S. N. (2003). The primate basal ganglia: Parallel and integrative networks. *Journal of Chemical Neuroanatomy, 26*(4), 317–330. https://doi.org/10.1016/j.jchemneu.2003.10.003

Haber, S. N., & Knutson, B. (2010). The reward circuit: Linking primate anatomy and human imaging. *Neuropsychopharmacology, 35*(1), 4–26. https://doi.org/10.1038/npp.2009.129

Halberstadt, A. G., Denham, S. A., & Dunsmore, J. C. (2002). Affective social competence. *Social Development, 10*(1), 79–119.

Hanish, L. D., Eisenberg, N., Fabes, R. A., Spinrad, T. L., Ryan, P., & Schmidt, S. (2004). The expression and regulation of negative emotions: Risk factors for

young children's peer victimization. *Development and Psychopathology, 16*, 335–353.

Hanson, J. L., Albert, W. D., Iselin, A. M. R., Carré, J. M., Dodge, K. A., & Hariri, A. R. (2016). Cumulative stress in childhood is associated with blunted reward-related brain activity in adulthood. *Social Cognitive and Affective Neuroscience, 11*(3), 405–412.

Hanson, J. L., Bos, W., Roeber, B. J., Rudolph, K. D., Davidson, R. J., & Pollak, S. D. (2017). Early adversity and learning: Implications for typical and atypical behavioral development. *Journal of Child Psychology and Psychiatry, 58*(7), 770–778. https://doi.org/10.1111/jcpp.12694

Hanson, J. L., Chung, M. K., Avants, B. B., Rudolph, K. D., Shirtcliff, E. A., Gee, J. C., … Pollak, S. D. (2012). Structural variations in prefrontal cortex mediate the relationship between early childhood stress and spatial working memory. *The Journal of Neuroscience, 32*(23), 7917–7925. https://doi.org/10.1523/JNEUROSCI.0307-12.2012

Hanson, J. L., Chung, M. K., Avants, B. B., Shirtcliff, E. A., Gee, J. C., Davidson, R. J., & Pollak, S. D. (2010). Early stress is associated with alterations in the orbitofrontal cortex: A tensor-based morphometry investigation of brain structure and behavioral risk. *The Journal of Neuroscience, 30*(22), 7466–7472. https://doi.org/10.1523/JNEUROSCI.0859-10.2010

Hanson, J. L., Knodt, A. R., Brigidi, B. D., & Hariri, A. R. (2015). Lower structural integrity of the uncinate fasciculus is associated with a history of child maltreatment and future psychological vulnerability to stress. *Development and Psychopathology, 27*, 1611–1619.

Harms, M. B., Shannon Bowen, K., Hanson, J. D., & Pollak, S. D. (2017). Instrumental learning and cognitive flexibility are impaired in children exposed to early life stress. *Developmental Science, 21*, e12596. https://doi.org/10.1111/desc.12596

Hart, H., & Rubia, K. (2012). Neuroimaging of child abuse: A critical review. *Frontiers in Human Neuroscience, 6*(52). https://doi.org/10.3389/fnhum.2012.00052. eCollection 2012.

Heleniak, C., Jenness, J. L., Vander Stoep, A., McCauley, E., & McLaughlin, K. A. (2015). Childhood maltreatment exposure and disruptions in emotion regulation: A transdiagnostic pathway to adolescent internalizing and externalizing psychopathology. Cognitive Therapy and Research, 40, 1–22. https://doi.org/10.1007/s10608-015-9735-z

Helmeke, C., Seidel, K., Poeggel, G., Bredy, T. W., Abraham, A., & Braun, K. (2009). Paternal deprivation during infancy results in dendrite- and time-specific changes of dendritic development and spine formation in the orbitofrontal cortex of the biparental rodent *Octodon degus*. *Neuroscience, 163*(3), 790–798. https://doi.org/10.1016/j.neuroscience.2009.07.008

Herringa, R. J., Birn, R. M., & Ruttle, P. L. (2013). Childhood maltreatment is associated with altered fear circuitry and increased internalizing symptoms by late adolescence. *Proceedings of the National Academy of Science, 110*(47), 19119–19124. https://doi.org/10.1073/pnas.1310766110/-/DCSupplemental

Herts, K. L., McLaughlin, K. A., & Hatzenbuehler, M. L. (2012). Emotion dysregulation as a mechanism linking stress exposure to adolescent aggressive behavior. *Journal of Abnormal Child Psychology, 40*(7), 1111–1122.

Holz, N. E., Boecker, R., Hohm, E., Zohsel, K., Buchmann, A. F., Blomeyer, D., … Laucht, M. (2015). The long-term impact of early life poverty on orbitofrontal cortex volume in adulthood: Results from a prospective study over 25 years. *Neuropsychopharmacology, 40*(4), 996–1004. https://doi.org/10.1038/npp.2014.277

Holz, N. E., Boecker-Schlier, R., Buchmann, A. F., Blomeyer, D., Jennen-Steinmetz, C., Baumeister, S., … Laucht, M. (2017). Ventral striatum and amygdala activity as convergence sites for early adversity and conduct disorder. *Social Cognitive and Affective Neuroscience, 12*(2), 261–272.

Honey, C. J., Kötter, R., & Breakspear, M. (2007). Network structure of cerebral cortex shapes functional connectivity on multiple time scales. *Proceedings of the National Academy of Sciences, 104*(24), 10240–10245. https://doi.org/10.1073/pnas.0701519104

Humphreys, K. L., & Zeanah, C. H. (2015). Deviations from the expectable environment in early childhood and emerging psychopathology. *Neuropsychopharmacology, 40*(1), 154–170.

Izard, C., Fine, S., Schultz, D., Mostow, A., Ackerman, B., & Youngstrom, E. (2016). Emotion knowledge as a predictor of social behavior and academic competence in children at risk. *Psychological Science, 12*(1), 18–23.

Joëls, M., Karst, H., Krugers, H. J., & Lucassen, P. J. (2007). Chronic stress: Implications for neuronal morphology, function and neurogenesis. *Frontiers in Neuroendocrinology, 28*(2–3), 72–96.

Kaplow, J. B., & Widom, C. S. (2007). Age of onset of child maltreatment predicts long-term mental health outcomes. *Journal of Abnormal Psychology, 116*(1), 176–187. https://doi.org/10.1037/0021-843X.116.1.176

Keil, V., & Price, J. M. (2009). Social information-processing patterns of maltreated children in two social domains. *Journal of Applied Developmental Psychology, 30*(1), 43–52. https://doi.org/10.1016/j.appdev.2008.10.003

Kim, J., & Cicchetti, D. (2010). Longitudinal pathways linking child maltreatment, emotion regulation, peer relations, and psychopathology. *Journal of Child Psychology and Psychiatry, 51*(6), 706–716.

Kim-Spoon, J., Cicchetti, D., & Rogosch, F. A. (2013). A longitudinal study of emotion regulation, emotion lability-negativity, and internalizing symptomatology in maltreated and nonmaltreated children. *Child Development, 84*(2), 512–527. https://doi.org/10.1111/j.1467-8624.2012.01857.x

Koizumi, M., & Takagish, H. (2014). The relationship between child maltreatment and emotion recognition. *PLoS One, 9*, e86093. https://doi.org/10.1371/journal.pone.0086093

Koss, K. J., Hostinar, C. E., Donzella, B., & Gunnar, M. R. (2014). Social deprivation and the HPA axis in early development. *Psychoneuroendocrinology, 50*, 1–13. https://doi.org/10.1016/j.psyneuen.2014.07.028

Krain Roy, A., Vasa, R. A., Bruck, M., Mogg, K., Bradley, B. P., Sweeney, M., et al. (2008). Attention bias to threat in pediatric anxiety disorders. *Journal of the American Academy of Child and Adolescent Psychiatry, 47*, 1189–1196. https://doi.org/10.1097/CHI.0b013e3181825ace

Kringelbach, M., & Rolls, E. (2004). The functional neuroanatomy of the human orbitofrontal cortex: Evidence from neuroimaging and neuropsychology. *Progress in Neurobiology, 72*(5), 341–372. https://doi.org/10.1016/j.pneurobio.2004.03.006

Ladouceur, C. D., Peper, J. S., Crone, E. A., & Dahl, R. E. (2012). White matter development in adolescence: The influence of puberty and implications for affective disorders. *Developmental Cognitive Neuroscience, 2*(1), 36–54.

Leeb, R.T., Paulozzi, L., Melanson, C., Simon, T., & Arias, I. (2008). *Child maltreatment surveillance: Uniform definitions for public health and recommended data elements*. Centers for Disease Control and Prevention, National Center for Injury Prevention and Control.

Linetzky, M., Pergamin-Hight, L., Pine, D. S., & Bar-Haim, Y. (2015). Quantitative evaluation of the clinical efficacy of attention bias modification treatment for anxiety disorders. *Depression and Anxiety, 32*(6), 383–391. https://doi.org/10.1002/da.22344

Liston, C., Miller, M. M., Goldwater, D. S., Radley, J. J., Rocher, A. B., Hof, P. R., … McEwen, B. S. (2006). Stress-induced alterations in prefrontal cortical dendritic morphology predict selective impairments in perceptual attentional set-shifting. *The Journal of Neuroscience, 26*(30), 7870–7874. https://doi.org/10.1523/JNEUROSCI.1184-06.2006

Lupien, S. J., McEwen, B. S., Gunnar, M. R., & Heim, C. (2009). Effects of stress throughout the lifespan on the brain, behaviour and cognition. *Nature Reviews Neuroscience, 10*(6), 434–445. https://doi.org/10.1038/nrn2639

Macleod, C., Rutherford, E., Campbell, L., Ebsworthy, G., & Holker, L. (2002). Selective attention and emotional vulnerability: Assessing the causal basis of their association through the experimental manipulation of attentional bias. *Journal of Abnormal Psychology, 111*(1), 107–123. https://doi.org/10.1037/0021-843X.111.1.107

Matthews, K., & Robbins, T. W. (2003). Early experience as a determinant of adult behavioural responses to reward: The effects of repeated maternal separation in the rat. *Neuroscience & Biobehavioral Reviews, 27*, 45–55. https://doi.org/10.1016/S0149-7634(03)00008-3

McCrory, E., De Brito, S. A., & Viding, E. (2010). Research review: The neurobiology and genetics of maltreatment and adversity. *Journal of Child Psychology and Psychiatry, 51*(10), 1079–1095.

McCrory, E., De Brito, S. A., & Viding, E. (2012). The link between child abuse and psychopathology: A review of neurobiological and genetic research. *Journal of the Royal Society of Medicine, 105*(4), 151–156. https://doi.org/10.1258/jrsm.2011.110222

McEwen, B. S., & Seeman, T. (1999). Protective and damaging effects of mediators of stress: Elaborating and testing the concepts of allostasis and allostatic load. *Annals of the New York Academy of Sciences, 896*(1), 30–47.

McLaughlin, K. A., Peverill, M., Gold, A. L., Alves, S., & Sheridan, M. A. (2015). Child maltreatment and neural systems underlying emotion regulation. *Journal of the American Academy of Child & Adolescent Psychiatry, 54*(9), 753–762. https://doi.org/10.1016/j.jaac.2015.06.010

Mogg, K., Waters, A. M., & Bradley, B. P. (2017). Attention Bias Modification (ABM): Review of effects of multisession ABM training on anxiety and threat-related attention in high-anxious individuals. *Clinical Psychological Science, 5*(4), 698–717. https://doi.org/10.1177/2167702617696359

Mogoaşe, C., David, D., & Koster, E. H. W. (2014). Clinical efficacy of attentional bias modification procedures: An updated meta-analysis. *Journal of Clinical Psychology, 70*(12), 1133–1157. https://doi.org/10.1002/jclp.22081

Moles, A., Kieffer, B. L., & D'Amato, F. R. (2004). Deficit in attachment behavior in mice lacking the μ-opioid receptor gene. *Science, 304*(5679), 1983–1986. https://doi.org/10.1126/science.1095943

Morris, A. S., Silk, J. S., Steinberg, L., Myers, S. S., & Robinson, L. R. (2007). The role of the family context in the development of emotion regulation. *Social Development, 16*, 361–388. https://doi.org/10.1111/j.1467-9507.2007.00389.x

Mostow, A. J., Izard, C. E., Fine, S., & Trentacosta, C. J. (2008). Modeling emotional, cognitive, and behavioral predictors of peer acceptance. *Child Development, 73*(6), 1775–1787.

Mueller, S. C., Hardin, M. G., Korelitz, K., Daniele, T., Bemis, J., Dozier, M., … Ernst, M. (2012). Incentive effect on inhibitory control in adolescents with early-life stress: An antisaccade study. Child Abuse & Neglect, 36(3), 217–225. https://doi.org/10.1016/j.chiabu.2011.10.010

Murray, E. A., O'Doherty, J. P., & Schoenbaum, G. (2007). What we know and do not know about the functions of the orbitofrontal cortex after 20 years of cross-species studies. *The Journal of Neuroscience, 27*(31), 8166–8169. https://doi.org/10.1523/JNEUROSCI.1556-07.2007

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science, 3*(5), 400–424. https://doi.org/10.1111/j.1745-6924.2008.00088.x

Norman, R. E., Byambaa, M., De, R., Butchart, A., Scott, J., Vos, T., & Tomlinson, M. (2012). The long-term health consequences of child physical abuse, emo-

tional abuse, and neglect: A systematic review and meta-analysis. *PLoS Medicine, 9*(11), e1001349.

Papoušek, H., & Papoušek, M. (2008). Cognitive aspects of preverbal social interaction between human infants and adults. In *Ciba Foundation Symposium 33 – Parent-Infant Interaction* (pp. 241–269). Chichester, UK: Wiley. https://doi.org/10.1002/9780470720158.ch14

Passingham, R. E., Stephan, K. E., & Kötter, R. (2002). The anatomical basis of functional localization in the cortex. *Nature Reviews Neuroscience, 3*(8), 606–616. https://doi.org/10.1038/nrn893

Pechtel, P., & Pizzagalli, D. A. (2011). Effects of early life stress on cognitive and affective function: An integrated review of human literature. *Psychopharmacology, 214*(1), 55–70.

Pechtel, P., & Pizzagalli, D. A. (2013). Disrupted reinforcement learning and maladaptive behavior in women with a history of childhood sexual abuse. *JAMA Psychiatry, 70*, 499–507.

Penton-Voak, I. S., Bate, H., Lewis, G., & Munafo, M. R. (2012). Effects of emotion perception training on mood in undergraduate students: Randomised controlled trial. *The British Journal of Psychiatry, 201*(1), 71–72. https://doi.org/10.1192/bjp.bp.111.107086

Penton-Voak, I. S., Thomas, J., Gage, S. H., McMurran, M., McDonald, S., & Munafo, M. R. (2013). Increasing recognition of happiness in ambiguous facial expressions reduces anger and aggressive behavior. *Psychological Science, 24*(5), 688–697. https://doi.org/10.1177/0956797612459657

Pergamin-Hight, L., Naim, R., Bakermans-Kranenburg, M. J., Van Ijzendoorn, M. H., & Bar-Haim, Y. (2015). Content specificity of attention bias to threat in anxiety disorders: A meta-analysis. *Clinical Psychology Review, 35*(C), 10–18. https://doi.org/10.1016/j.cpr.2014.10.005

Perlman, S. B., Kalish, C. W., & Pollak, S. D. (2008). The role of maltreatment experience in children's understanding of the antecedents of emotion. *Cognition and Emotion, 22*(4), 651–670. https://doi.org/10.1080/02699930701461154

Pine, D. S., Mogg, K., Bradley, B. P., Montgomery, L. A., Monk, C. S., McClure, E., … Kaufman, J. (2005). Attention bias to threat in maltreated children: Implications for vulnerability to stress-related psychopathology. *American Journal of Psychiatry, 162*(2), 291–296.

Pizzagalli, D. A. (2014). Depression, stress, and anhedonia: Toward a synthesis and integrated model. *Annual Review of Clinical Psychology, 10*(1), 393–423.

Pollak, S. D. (2015). Multilevel developmental approaches to understanding the effects of child maltreatment: Recent advances and future challenges. *Development and Psychopathology, 27*(4, Pt. 2), 1387–1397.

Pollak, S. D., Cicchetti, D., Hornung, K., & Reed, A. (2000). Recognizing emotion in faces: Developmental effects of child abuse and neglect. *Developmental Psychology, 36*(5), 679–688. https://doi.org/10.1037/0012-1649.36.5.679

Pollak, S. D., & Kistler, D. J. (2002). Early experience is associated with the development of categorical representations for facial expressions of emotion. *Proceedings of the National Academy of Sciences of the United States of America, 99*(13), 9072–9076.

Pollak, S. D., & Sinha, P. (2002). Effects of early experience on children's recognition of facial displays of emotion. *Developmental Psychology, 38*, 784–791.

Pollak, S. D., & Tolley-Schell, S. A. (2003). Selective attention to facial emotion in physically abused children. *Journal of Abnormal Psychology, 112*(3), 323–338.

Pollak, S. D., Vardi, S., Putzer Bechner, A. M., & Curtin, J. J. (2005). Physically abused children's regulation of attention in response to hostility. *Child Development, 76*(5), 968–977. https://doi.org/10.1111/j.1467-8624.2005.00890.x

Pryce, C. R., Dettling, A. C., Spengler, M., Schnell, C. R., & Feldon, J. (2004). Deprivation of parenting disrupts development of homeostatic and reward systems in Marmoset monkey offspring. *Biological Psychiatry, 56*(2), 72–79. https://doi.org/10.1016/j.biopsych.2004.05.002

Renwick, B., Campbell, I. C., & Schmidt, U. (2013). Attention bias modification: A new approach to the treatment of eating disorders? *International Journal of Eating Disorders, 46*(5), 496–500. https://doi.org/10.1002/eat.22107

Ridderinkhof, K. R. (2004). The role of the medial frontal cortex in cognitive control. *Science, 306*(5695), 443–447. https://doi.org/10.1126/science.1100301

Romens, S. E., & Pollak, S. D. (2011). Emotion regulation predicts attention bias in maltreated children at-risk for depression. *Journal of Child Psychology and Psychiatry, 53*(2), 120–127. https://doi.org/10.1111/j.1469-7610.2011.02474.x

Russo, S. J., & Nestler, E. J. (2013). The brain reward circuitry in mood disorders. *Nature Reviews Neuroscience, 14*(9), 609–625.

Schoenbaum, G., & Roesch, M. (2005). Orbitofrontal cortex, associative learning, and expectancies. *Neuron, 47*(5), 633–636.

Schoenbaum, G., Roesch, M. R., Stalnaker, T. A., & Takahashi, Y. K. (2009). A new perspective on the role of the orbitofrontal cortex in adaptive behaviour. *Nature Reviews Neuroscience, 10*(12), 885–892. https://doi.org/10.1038/nrn2753

Schultz, W., & Dickinson, A. (2000). Neuronal coding of prediction errors. *Annual Review of Neuroscience, 23*(1), 473–500. https://doi.org/10.1146/annurev.neuro.23.1.473

Shackman, J. E., Fatani, S., Camras, L. A., Berkowitz, M. J., Bachorowski, J.-A., & Pollak, S. D. (2010). Emotion expression among abusive mothers is associated with their children's emotion processing and problem behaviours. *Cognition and Emotion, 24*(8), 1421–1430. https://doi.org/10.1080/02699930903399376

Shackman, J. E., & Pollak, S. D. (2014). Impact of physical maltreatment on the regulation of negative affect and

aggression. *Development and Psychopathology, 26*, 1–13. https://doi.org/10.1017/S0954579414000546

Shackman, J. E., Shackman, A. J., & Pollak, S. D. (2007). Physical abuse amplifies attention to threat and increases anxiety in children. *Emotion, 7*(4), 838–852. https://doi.org/10.1037/1528-3542.7.4.838

Shechner, T., & Bar-Haim, Y. (2016). Threat monitoring and attention-bias modification in anxiety and stress-related disorders. *Current Directions in Psychological Science, 25*(6), 431–437. https://doi.org/10.1177/0963721416664341

Shechner, T., Britton, J. C., Pérez-Edgar, K., Bar-Haim, Y., Ernst, M., Fox, N. A., … Pine, D. S. (2011). Attention biases, anxiety, and development: Toward or away from threats or rewards? *Depression and Anxiety, 29*(4), 282–294. https://doi.org/10.1002/da.20914

Shields, A., & Cicchetti, D. (1998). Reactive aggression among maltreated children: The contributions of attention and emotion dysregulation. *Journal of Clinical Child Psychology, 27*(4), 381–395.

Singer, M. J., Humphreys, K. L., & Lee, S. S. (2016). Coping self-efficacy mediates the association between child abuse and ADHD in adulthood. *Journal of Attention Disorders, 20*(8), 695–703. https://doi.org/10.1177/1087054712465337

Springer, K. W., Sheridan, J., Kuo, D., & Carnes, M. (2007). Long-term physical and mental health consequences of childhood physical abuse: Results from a large population-based sample of men and women. *Child Abuse & Neglect, 31*, 517–530.

Stansbury, K., & Gunnar, M. R. (1994). Adrenocortical activity and emotion regulation. *Monographs of the Society for Research in Child Development, 59*(2–3), 108–134.

Stoddard, J., Sharif-Askary, B., Harkins, E. A., Frank, H. R., Brotman, M. A., Penton-Voak, I. S., et al. (2016). An open pilot study of training hostile interpretation bias to treat disruptive mood dysregulation disorder. *Journal of Child and Adolescent Psychopharmacology, 26*(1), 49–57. https://doi.org/10.1089/cap.2015.0100

Tamietto, M., & de Gelder, B. (2010). Neural bases of the non-conscious perception of emotional signals. *Nature Reviews Neuroscience, 11*(10), 697–709.

Teicher, M. H., Anderson, C. M., Ohashi, K., & Polcari, A. (2014). Childhood maltreatment: Altered network centrality of cingulate, precuneus, temporal pole and insula. *Biological Psychiatry, 76*(4), 297–305. https://doi.org/10.1016/j.biopsych.2013.09.016

Teisl, M., & Cicchetti, D. (2007). Physical abuse, cognitive and emotional processes, and aggressive/disruptive behavior problems. *Social Development, 17*(1), 1–23. https://doi.org/10.1111/j.1467-9507.2007.00412.x

Thomaes, K., Dorrepaal, E., & Draijer, N. (2010). Reduced anterior cingulate and orbitofrontal volumes in child abuse-related complex PTSD. *Journal of Clinical Psychiatry, 71*(12), 1636. https://doi.org/10.4088/JCP.08m04754blu

Thompson, R. A. (1994). Emotion regulation: A theme in search of a definition. In N. A. Fox (Ed.), *The development of emotion regulation: Biological and behavioral considerations*. Monographs of the Society for Research in Child Development, 59(2/3, Serial No. 240), 25–52. Chicago, IL.

Vachon, D. D., Krueger, R. F., Rogosch, F. A., & Cicchetti, D. (2015). Assessment of the harmful psychiatric and behavioral effects of different forms of child maltreatment. *JAMA Psychiatry, 72*(11), 1135–1138. https://doi.org/10.1001/jamapsychiatry.2015.1792

van Dam, D. S., Korver-Nieberg, N., Velthorst, E., Meijer, C. J., & de Haan, L. (2014). Childhood maltreatment, adult attachment and psychotic symptomatology: A study in patients, siblings and controls. *Social Psychiatry and Psychiatric Epidemiology, 49*(11), 1759–1767.

van Harmelen, A.-L., van Tol, M.-J., Demenescu, L. R., van der Wee, N. J. A., Veltman, D. J., Aleman, A., … Elzinga, B. M. (2013). Enhanced amygdala reactivity to emotional faces in adults reporting childhood emotional maltreatment. *Social Cognitive and Affective Neuroscience, 8*(4), 362–369.

Wager, T. D., Davidson, M. L., Hughes, B. L., Lindquist, M. A., & Ochsner, K. N. (2008). Prefrontal-subcortical pathways mediating successful emotion regulation. *Neuron, 59*(6), 1037–1050.

Weller, J. A., & Fisher, P. A. (2013). Decision-making deficits among maltreated children. *Child Maltreatment, 18*(3), 184–194. https://doi.org/10.1177/1077559512467846

Early Deprivation and Children's Emotional Development: A Developmental Perspective

Nicole B. Perry and Megan R. Gunnar

Abstract

Early adverse rearing environments, in which children experience varying degrees of neglect, deprive the developing brain from experience-expectant caregiving mechanisms that facilitate the development of neural and physiological systems underlying emotional functioning. Caregiver neglect also denies children important social interactions needed to acquire behavioral skills that support emotional competence. Although further work in this area is still needed, our knowledge regarding the association between early deprivation and children's emotional development has grown considerably in the last decade. In this chapter, we first discuss animal models that support developmental theories underscoring the importance of the caregiver–infant relationship for emotional development. We then acknowledge how varying degrees of neglect may be differentially associated with subsequent emotional outcomes. Finally, we review empirical work in this area from a developmental perspective by addressing how early neglect may impact the development of biological and behavioral mechanisms that underlie emotional functioning across multiple developmental periods.

N. B. Perry (✉) · M. R. Gunnar
Institute of Child Development, University of Minnesota, Minneapolis, MN, USA
e-mail: nperry@umn.edu; gunnar@umn.edu

Developmental scientists have underscored the importance of consistent, sensitive, and responsive early caregiving experiences for children's emotional development for decades. In his evolutionary theory of attachment, John Bowlby discussed the biological adaptiveness of specific infant behaviors that serve to initiate and maintain contact with a primary caregiver (Bowlby, 1988). Bowlby argued that a responsive interaction history between the infant and the caregiver would produce a relationship that provides a sense of security for the infant, which in turn would allow for greater exploration of the environment and learning, and therefore would significantly influence the child's subsequent emotional adaptation to a variety of challenges (Bowlby, 1988).

Work by Alan Sroufe also emphasized the role of the infant–parent relationship for young children's emotional functioning and behavioral adjustment. Sroufe (1989, 1996) described emotional development as a transition from almost complete dependence on a caregiver during infancy to increasingly autonomous functioning in childhood and adolescence. He theorized that early infant–caregiver relationships characterized by positive and negative affective exchanges, experiences that allow for arousal escalation and de-escalation, and frequent occurrences of caregivers effectively managing infant distress may later help children to be better able recognize emotions and emotional

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_29

states, flexibly manage impulses and feelings, and independently maintain organized behavior during emotionally charged contexts. Thus, the caregiver is embedded as part of the infant's early developing emotional regulatory system. The general hypothesis is that if early trust in others, social stimulation, positive expectations, and the capacity to maintain organized behavior during emotionally arousing contexts are established within the infant–caregiver dyad, in childhood, children may be on a trajectory toward adaptive social and emotional outcomes (Bowlby, 1973; Sroufe, 1996).

At a biological level, these early relationships are critical because they are believed to influence the organization of neural circuits within the developing brain that are responsible for the regulation of emotion, stress, attention, and memory such as the amygdala, hypothalamus, hippocampus, and the anterior cingulate cortex (Cohen et al., 2006; Maheu et al., 2010; Tottenham et al., 2011). During reciprocal face-to-face interactions, infants are exposed to cognitive and social information and are given opportunities to practice the interpersonal coordination of biological rhythms, to regulate emotions with assistance, and to build the foundations of adult communication (Beebe & Gerstman, 1980; Feldman, Greenbaum, & Yirmiya, 1999). Because the brain organizes its neural circuitry based on its activity and because the infant's emotions and behaviors during these exchanges are the product of brain activity, with each experience of emotional arousal and regulation, the brain in conjunction with the child's genome is building its own architecture. That is, as Greenough, Black, and Wallace (1987) argued, the human genome expects certain inputs in order to develop its brain architecture. A critical expected input is contact with a responsive caregiving adult. If these early caregiving experiences are not present, or if they are greatly diminished, as is the case with early neglect, brain architecture may be altered in ways which may result in disordered development. Indeed, a number of emotional and behavioral problems have been documented in children who have experienced early neglect (e.g., Fries & Pollak, 2004; Hostinar, Stellern, Schaefer, Carlson, & Gunnar, 2012; Nelson, Westerlund, McDermott, Zeanah, & Fox, 2013).

Throughout this chapter, we review advances made in the study of early deprivation and emotional functioning. First, we discuss insights into this association that we have gained from animal models. Next, we define the varying degrees of neglect children experience and note that different degrees of neglect could have diverse associations with emotional adaptation. Finally, although further work is still needed to identify the specific developmental mechanisms underlying the associations between early adverse experiences and emotional well-being, we address specific biological and behavioral factors that may be involved. Importantly, we utilize a developmental perspective to review how early neglect may impact the development of neural functioning, biological systems, and behavioral control that underlie successful emotional functioning across multiple developmental periods.

Insights from Animal Models

Children who experience extreme neglect and deprivation early in development exhibit varying degrees of emotional dysregulation, including increased anxiety and a lower threshold for defensive reactions, emotional lability, and mix of inhibition and impulsivity (Bakermans-Kranenburg et al., 2011). However, because we cannot, and of course would not, randomly assign children to these deprived rearing, we cannot determine whether the emotional profile outlined above is actually caused by their early experiences. However, cause and effect can be sorted out in animal studies, and it is noteworthy that animal studies of early adverse caregiving yield behavioral patterns highly reminiscent of those observed in children. Seymour Levine's work beginning in the 1950s showed that early experiences that affect the infant–caregiver relationship influence emotional development and stress regulation (Levine, 1957). Through the work of Michael Meaney and colleagues (Zhang, Labonté, Wen, Turecki, & Meaney, 2013), we now know that these effects can be traced to the

influence of maternal care during a critical early period on the epigenome; poor maternal care results in epigenetic effects in rat pups that leads to poor stress regulation and hyper-fearfulness. Notably, treatment with substances that reverse the epigenetic effects corrects stress regulation and reduces fearfulness (Weaver et al., 2005). Similar alterations to the epigenome have been found in the brains of adults who were maltreated as children (McGowan et al., 2009).

Maternal separation in rats and mice is used as a model of neglect or deprivation because there is no caregiver for the pup during long separation periods. This is different than early handling paradigms which remove rat pups from their mother for only short periods of time, mimicking what pups might experience in the wild when the dam leaves the nest to feed. Researchers have used these separation models to investigate the effects of early deprivation on affective development and specific emotional disorders, such as anxiety and depression. Persistent depressed moods, or a reduced capacity to experience pleasure, are core features of depressive disorders (American Psychiatric Association, 2013) and these characteristics have been the target outcomes for much empirical work. For example, in Wistar rats, isolation of rat pups from their mother and littermates for 4 hours a day on postnatal days 1 through 14 was associated with reduced social motivation and less reward seeking behavior in adulthood relative to pups left undisturbed (Rüedi-Bettschen et al., 2006). Matthews and colleagues found that rat pups separated from their mothers on 10 occasions across postnatal days 5 through 10 showed increased weight gain, a blunted locomotor response to a novel environment, and a blunted response to upward and downward shifts in the reward magnitude of a sugar solution (Matthews, Wilkinson, & Robbins, 1996).

When looking at models of anxiety, Kalinichev, Easterling, Plotsky, and Holtzman (2002) demonstrated that infant rat pups separated from their mother for 3 hours a day over the first 2 weeks of life were more likely to display anxiety-like behaviors and exaggerated neuroendocrine responses to stress relative to non-separated peers. Specifically, in adulthood maternally-separated males over-secreted corticosterone, a steroid hormone that is the rat equivalent of cortisol, in response to mild stress, and both males and females were less likely to explore open arms of the elevated plus-maze. In a similar study using the plus-maze task, maternal deprivation for just 24 h at postnatal day 9 induced a latent behavioral disposition toward anxiety 3 months later (Barna et al., 2003). These studies provide strong evidence that deprivation of an effective caregiver for long periods of time in rats is associated with decreased activity, motivation, reward seeking, and exploration of novelty. Although this work is not directly translatable to human models of depression and anxious behavior, findings support current work with human populations and suggest that animal models may provide important insight into how early emotional and physical neglect by the caregiver are associated with a potential predisposition toward later psychological maladjustment.

The work using animal models to identify the effects of early deprivation on emotional development at both a biological and a behavioral level has been incredibly influential. Few of these studies, however, focus specifically on what aspects of caregiving (e.g., provision of warmth, tactile stimulation, feeding, maternal odor) were critical in affecting infant regulation as all were removed in separation paradigms. Myron Hofer addressed this question by removing different aspects of maternal care and found that different aspects of infant functioning were affected (Hofer, 1994). For example, two-week-old rat pups whose mothers had been removed from their cage had very low heart rates and body temperature, they also showed strange movements and diminished responsiveness.

After supplying heat through the cage floor and raising pup's body temperatures to normal levels, cardiac rates were just as low, but behavior changed from slow to hyperactive, suggesting that maternal separation could produce a behavioral state that was overactive or depressed depending on one aspect of mothers' care (i.e., warmth). What could prevent low cardiac response during maternal separation was sup-

plying rat pups with milk (Hofer, 1973a). Interestingly, however, providing food had no effect on rat pup's behavioral state (Hofer, 1973b). Finally, Hofer and colleagues were able to show graded decreases in pup ultrasonic protest calling depending on the number of sensory items the rat pup was exposed to and the extent to which these items were arranged to resemble littermates. A rubber model that was warm but was not soft and had no olfactory cues was ineffective, a piece of soft fur laid flat on the floor was somewhat effective, while a flashlight battery that was warm, wrapped in fur, and scented with home cage shavings was almost as effective as an anesthetized littermate (Hofer & Shair, 1980). These studies led him to argue that there were "hidden regulators" embedded in mother–pup interactions that allow the mother to control the intensity, level, and patterns of the infant rat's biological and behavioral response systems. These individual regulators control behavior, sleep–wake states, and autonomic and endocrine functioning within the infant rat and therefore control early emotion states associated with maternal separation and loss (Hofer, 1994).

Other researchers have focused on the response-contingent nature of maternal care as a critical element lost with early deprivation. For example, Mineka, Gunnar, and Champoux (1986) raised infant monkeys in groups of four, but gave some groups control of lights and treats, while the other group received this stimulation noncontingently, and one group received no extra stimulation. The group who could obtain extra stimulation contingent on their own actions were less fearful and were more willing to explore during a novel playroom test than the monkeys who were not allowed any control. In a similar way, giving the infant monkey a cloth surrogate that rocks when moved by the infant results in more normative development than providing it with a stationary cloth surrogate that does not respond to anything that the infant does (Mason & Berkson, 1974). Finally, Baram and colleagues (Baram et al., 2012) have emphasized the role of predictable patterns of maternal care. Specifically, they argue that when maternal care is fragmented and disorganized this is stressful for the infant and this stress alters numerous aspects of the infant's development.

Work with human populations is not able to remove elements of caregiving experimentally over long periods of time to determine how each dimension in isolation influences emotional development. However, this animal work can provide developmental scientists with ideas regarding how various aspects of parental care affect children's emotional functioning.

Aspects of Caregiving and Degrees of Neglect

What is thought to be normative caregiving behavior and the appropriate amount of infant–caregiver interactions varies considerably across and within cultures. However, neglect is broadly defined as continued disruption in, or a considerable lack of, caregiver attention and responsiveness (Hildyard & Wolfe, 2002). To researchers, neglect is often referred to as deprivation and includes the absence of specific attention and responding based on the developmental needs of the child. Although neglect receives considerably less attention than physical or sexual abuse (De Bellis, 2005; Minty & Pattinson, 1994), it is involved in 78% of all maltreatment cases in the United States (U.S. Department of Health and Human Services, 2011); therefore, understanding its effects on healthy development is of great importance.

In a working paper, the National Scientific Council on the Developing Child delineated four types of caregiver unresponsiveness ranging in degree of severity (National Scientific Council on the Developing Child, 2012). The first, *occasional inattention,* which is defined as diminished attention on an intermittent basis that occurs in an otherwise loving and responsive environment, is not thought to have harmful developmental effects. In fact, some developmental scientists posit that some variation in attention may be beneficial such that children may be able to more quickly distinguish between the "self" and "other" (Tronick & Gianino, 1986).

The second type of unresponsiveness, *chronic under-stimulation,* is defined as diminished levels of child-focused attention and thus less support of children's development across multiple developmental domains. Examples include having few daily interactions that allow children opportunities to engage with adults or leaving children alone or in front of a television for hours at a time. Chronic under-stimulation may be addressed and remedied by educating parents about the need to provide more child-focused attention and/or enrolling children in programs that provide such stimulation.

The third type of unresponsiveness, *severe neglect within the family*, constitutes continued disruption and considerable absence of mutual exchanges between infants and their caregivers, and may also be associated with a failure to provide for a child's basic nutritional and health needs. Children who experience this level of deprivation have no stable source of reliable care and are at risk for serious developmental problems across multiple developmental domains.

Finally, the fourth type of unresponsiveness is *severe neglect within an institution* and is characterized by children having very few one-on-one interactions, being ignored or un-stimulated for almost all of their awake hours, and no adult relationships that are reliably responsive. This type of neglect comes from institutions having large numbers of infants with little to no training. Although basic food and shelter needs may be met, neglect of this kind has been shown to be incredibly harmful for both physical and psychosocial development (Lionetti, Pastore, & Barone, 2015; van Ijzendoorn et al., 2011; Wiik et al., 2011).

Importantly, the developmental impairments that occur in children experiencing institutional neglect are not the result of pre-existing child factors, although some children may be genetically or constitutionally more vulnerable to institutional neglect. Intervention projects that improve the environment and responsiveness of the staff within orphanages improve development across multiple domains in most children (The St. Petersburg-USA Orphanage Research Team, 2008). Likewise, selecting children at random to be placed in research-supported foster care homes also results in broad improvements in functioning relative to children who remain in orphanage care (e.g., Bos et al., 2011).

We identify these four levels of neglect to highlight how varying degrees of unresponsiveness may be associated differently with the development of biological systems and behavioral skills that underlie emotional functioning. For example, under-stimulation within the context of a generally loving parent–child relationship might not be expected to affect the development of negative emotionality, while severe neglect within the family, by definition, involves some level of rejection of children's attempts to get their needs met, and this rejection likely does affect the development of negative reactivity. In addition, the impact of neglect can be manifested differently across developmental periods. Thus, throughout the chapter, we address adverse emotional consequences of neglect in a developmentally appropriate manner by noting the severity of neglect and the developmental period in which the effects of deprivation are observed.

Early Deprivation and Biological Mechanisms Underlying Emotional Functioning

Neglect and deprivation in early childhood have biological consequences in both human and animal populations. As noted, these consequences include the development of brain architecture, neural circuitry, and stress-response systems, all of which contribute to healthy emotional functioning across the lifespan. In the following section, we highlight associations between early neglect and the development of biological mechanisms that underlie emotional development.

Effects of Deprivation on HPA Activity and Emotional Development

Day-to-day functioning requires the body to physiologically adapt to stressors of varying degrees to maintain functioning. Threats to our

well-being, whether actual or perceived, lead to a cascade of events resulting in increased glucocorticoids (cortisol in primates and corticosterone in rats and mice), hormones serving to promote survival by contributing to optimal brain and body functioning. In response to a stressor, the paraventricular nucleus (PVN) within the hypothalamus increases the production of the corticotropin-releasing hormone (CRH) and arginine vasopressin (AVP). Increased amounts of CRH then travel from the hypothalamus to the anterior part of the pituitary gland, which sets in motion the production and release of the adrenocorticotropic hormone (ACTH). In turn, ACTH travels through the bloodstream to the adrenal glands, where it stimulates the production of cortisol (Gunnar & Cheatham, 2003). Cortisol is necessary for survival, but when not regulated properly, it can have deleterious consequences for health, including emotional functioning (Gunnar & Adam, 2012).

The developmental changes occurring in basal HPA activity and HPA reactivity are thought to be socially regulated such that early social experiences play a role in shaping basal rhythms and reactivity of the HPA axis (Hostinar et al., 2012; Tarullo & Gunnar, 2006). Most notably over the first year of life, the HPA axis and likely other stress-mediating systems come under strong social regulation. Consistent and responsive caregiving allows the child to express and experience distress and communicate emotions in a way that elicits caregiver support without having to activate the HPA system. That is, when caregivers can serve as a social buffer, they may be able to block elevations in cortisol even when a child is visibly upset or frightened (for a review, Gunnar, 2017).

Developmental scientists have provided support to the social regulation hypothesis and demonstrated that toddlers who showed fear when approached by a live clown do not show elevations in cortisol if they are accompanied by a parent who responds sensitively to the child (Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996). Similarly, studies show that young children with non-parental care providers who are sensitive, responsive, and stimulating show no increase in cortisol when separated from their primary caregiver. If these temporary caregivers show low responsivity, are insensitive, or cold, elevations in cortisol are observed (Dettling, Parker, Lane, Sebanc, & Gunnar, 2000; Gunnar, Larson, Hertsgaard, Harris, & Brodersen, 1992).

Given that deprivation results in varying degrees of caregiver neglect, and the developing HPA system requires early responsive caregiving to facilitate proper regulation of the HPA axis, early aversive experiences characterized by little to no social interaction can have deleterious effects on HPA functioning and brain development. Children who experience neglect are at greater risk for developing insecure emotional attachments with their caregivers (Naughton et al., 2013), particularly insecure disorganized attachments, characterized by a lack of a coherent strategy when managing stressful situations in the presence of a caregiver. These children have a history of caregivers not responding to or meeting their needs and therefore develop a decreased sense of trust and security that their caregiver will respond and be effective in assisting them in the future (Sroufe, 1996). Because of the decreased lack of trust, they are often unable to use caregivers as a resource for effective coping during stressful circumstances. Without the use of a responsible caregiver as a buffer, the early development of children's HPA system may be particularly vulnerable to stress. Support for this hypothesis comes from studies that show elevated cortisol reactivity in young children displaying insecure attachments (e.g., Bernard & Dozier, 2010; Luijk et al., 2010).

Additional support for the hypothesis that the early developing HPA system may be particularly vulnerable without a responsive caregiver comes from work using neglected family-reared children, foster children, and post-institutionalized (PI) children. In general, across degrees of neglect, early deprivation is associated with disturbances in normal diurnal cortisol rhythms and cortisol reactivity to stress (e.g., Bruce, Fisher, Pears, & Levine, 2009; Koss, Hostinar, Donzella, & Gunnar, 2014; Koss, Mliner, Donzella, & Gunnar, 2016; McLaughlin

et al., 2015). There is also evidence that transitioning to low-risk environments has beneficial effects on stress responding, but the age at which children make this transition, and the duration in which they experienced neglect, can affect the degree to which plasticity exists within the HPA system (e.g., Gunnar, Morison, Chisholm, & Schuder, 2001; McLaughlin et al., 2015). Of note, some research has provided evidence to suggest that with puberty, the HPA axis of children who were deprived early in life may normalize to that of non-deprived children if their current experiences are no longer aversive (King et al., 2017; Quevedo, Johnson, Loman, LaFavor, & Gunnar, 2012).

Although we know that being deprived of expectable social experiences during early childhood is associated with dysregulation of the HPA system, and that HPA dysregulation has implications for emotional development, emotions do not drive HPA functioning nor are they the direct result of HPA reactivity. Nonetheless, HPA activity can provide insight into emotions and their associations with neurobehavioral development. There is evidence, for example, that with the development of self-regulatory skills, the association between the emotional salience of a stressful situation and children's HPA response to that situation may reflect self-regulatory competencies.

Smeekens, Riksen-Walraven, and van Bakel (2007) demonstrated that children with fewer cognitive, affective, and behavioral self-regulatory capacities showed stronger cortisol reactions than children with greater self-regulatory skills during a stressful context (Smeekens et al., 2007). Indeed, training in cognitive-behavioral stress management can produce disassociations between emotional appraisals of threat and emotional responding (Gaab, Sonderegger, Scherrer, & Ehlert, 2006). Thus, as children are increasingly able to independently regulate their emotions, behaviors, and thoughts, they may be able to use these self-regulatory skills to cope with stress in ways that do not require HPA activation. Depending on the degree of neglect children experience, however, self-regulatory development may be stunted, resulting in increased HPA reactivity to even mild stressors. Chronic activation of the HPA system over time is believed to downregulate the system, resulting in blunted cortisol levels during stressors and at the peak of the diurnal rhythm (Fries, Hesse, Hellhammer, & Hellhammer, 2005; Gunnar & Vazquez, 2001; Heim, Ehlert, & Hellhammer, 2000). As we previously noted, this pattern is often observed in children who experience early family neglect as well as institutional care (e.g., Koss et al., 2014, 2016; McLaughlin et al., 2015).

While chronic activation of the HPA system can downregulate CRH activity in the hypothalamus, the same chronic activation can facilitate an upregulation of CRH activity in the amygdala, which is thought to play an important role in processing emotion and identifying events as emotionally important (Pessoa, 2017). A recent review of CRH's role in fear memory and anxiety concluded that CRH in the central nucleus of the amygdala contributes importantly to fear memory, while in the bed nucleus of the stria terminalis (sometimes thought of as the extended amygdala) CRH-producing neurons contribute to anxiety (Gafford & Ressler, 2015).

CRH can only have an effect if it binds with CRH receptors. The CRH1 receptor in particular is important in the regulation of fear and anxiety. In rodent models, there is evidence that early maternal deprivation increases CRH1 receptors and potentially biases the brain to perceiving events as stressful and threatening (Sánchez, Ladd, & Plotsky, 2001). Moreover, chronic activation of the HPA system is also believed to increase the number of CRH1 receptors (De Kloet, 2013; Heim, Owens, Plotsky, & Nemeroff, 1997). Thus, increased CRH1 receptors resulting from greater neglect and chronic HPA activation may bias a developing child toward detecting and responding to threat, rather than engaging in activities that support future-oriented goals. This bias may be beneficial for survival while in a threatening environment, but depending on the quality of subsequent environments, it may set children on developmental trajectories that increase the risk for acquiring affective disorders (Doom & Gunnar, 2013).

Varying patterns of imbalance within the HPA system are to the development of affective disorders such as depression (Lopez-Duran, Kovacs, & George, 2009). However, whether the dysregulation of the HPA axis precedes or follows the onset of disorder is not yet certain. In some work, there is evidence that it precedes and predicts onset (Adam et al., 2010). In post-traumatic stress disorder (PTSD), there are instances in which dysregulation of the HPA axis seems to precipitate or co-occur with the development of the disorder (Luo et al., 2012), and it has been argued that dysregulation is a necessary precursor. Indeed, in a recent re-analysis of a longitudinal study of PTSD, latent growth mixture modeling identified trajectories of symptoms and revealed a unique pathway from childhood abuse to lower cortisol at the time of adult trauma, which in turn predicted PTSD (Galatzer-Levy, Ma, Statnikov, Yehuda, & Shaley, 2017).

As these results suggest, it is possible that when mood disorders emerge in adolescence or adulthood they are precipitated by stressful experiences that the individual is ill-equipped to deal with because their early life history has resulted in dysregulation of their stress physiology. Heim and Nemeroff (2001) have made this argument for forms of adult depression that are accompanied by hyperactivity of the HPA axis. However, it may take more than early neglect and abuse to produce a stress-vulnerable individual. The three-hit hypothesis (Daskalakis, Bagot, Parker, Vinkers, & de Kloet, 2013) argues that genetic vulnerability, early adversity during critical periods, and later life stressors, combine to produce the most disordered outcomes. Indeed, recent reviews of the literature strongly support the complex interplay between genes, epigenetics, early experiences, and later challenges in shaping ordered and disordered emotional functioning (Heim & Binder, 2012). Thus, future work on the sequelae of childhood neglect and depression need to embrace multi-level analyses of functioning across different periods of development.

Researchers have also used functional imaging to assess the relation between HPA activity and emotion, particularly the impact of stress on emotional learning and memory (van Stegeren, 2009). This is likely because depressive and anxiety disorders are characterized by a failure to regulate emotion and disturbed emotional memory. For example, the hippocampus, involved in the formation of new memories, and the amygdala, involved in emotional memory, are both dependent on norepinephrine (NE) for these functions (Strange & Dolan, 2004). While memory and encoding consolidation seems to be elevated by cortisol levels (e.g., Andreano & Cahill, 2006; McGaugh, McIntyre, & Power, 2002), this enhancing effect is permissive in that it typically allows NE to stimulate emotion memory encoding (Roozendaal, Castello, Vedana, Barsegyan, & McGaugh, 2008; van Stegeren et al., 2007). In support of this, animal and human models demonstrate that high cortisol levels evoked during a stress task lead to better memory of emotional stimuli when paired with higher NE levels. It is also true that without cortisol, NE is less effective in forming memories for emotional events. For example, in a functional magnetic resonance imaging (fMRI) study, van Stegeren et al. (2007) demonstrated that participants with higher cortisol levels had significantly stronger emotional responses to emotionally stimulating pictures compared with participants with lower cortisol levels. Importantly, blocking NE levels in the brain by giving participants a beta blocker prevented associations between cortisol and amygdala activation (van Stegeren et al., 2007).

Although beneficial effects of cortisol elevations or stress exposure have been found in relation to emotional memory consolidation (e.g., Buchanan & Lovallo, 2001; Kuhlmann & Wolf, 2006), studies that have administered cortisol right before retrieval have reported decreases in memory performance (e.g., de Quervain et al., 2003). Interestingly, these negative effects have been found to be stronger for emotional stimuli (Buchanan, Tranel, & Adolphs, 2006; Kuhlmann, Piel, & Wolf, 2005). Thus, cortisol may play two roles in memory for emotional events. Initially, it allows or supports the actions of NE in encoding the emotional memory. Then as NE levels decrease, cortisol elevations following the emotionally stressful event activate genes that then interfere with the formation of new memories,

thus allowing consolidation of the emotional memory that was just formed (Krugers, Zhou, Joëls, & Kindt, 2011).

It is important to acknowledge that the majority of the work that these conclusions have been drawn from has been conducted with adults or animals. Parallel work with children is far scarcer (for a review see Quas & Klemfuss, 2014). Because many of the methodological approaches employed with adults would be considered unethical for children (e.g., administering stimulants or showing highly emotionally evocative clips), most developmental researchers have relied primarily on naturally occurring stressors. For instance, Quas and colleagues (Quas, Bauer, & Boyce, 2004) obtained saliva samples to measure HPA activity through cortisol before and after children were exposed to a fire alarm and then asked children to recount what happened during the alarm. Results indicated that greater increases in cortisol were associated with better memory.

In a few instances, researchers have used arousing laboratory procedures to induce arousal and test the effects on encoding. For example, in two studies, researchers obtained saliva samples during the Trier Social Stress Test (TSST), a laboratory task designed to elicit physiological arousal by requiring children to complete a speech and an arithmetic task in front of observers for evaluation. Participants returned two weeks later for a surprise memory test. Results of the first study showed that increases in cortisol predicted better memory recall in 9–12-year-olds but not in a college sample of young adults (Quas, Yim, Edelstein, Cahill, & Rush, 2011). The authors suggested that the discrepant findings may be because the college students knew more about psychological experiments in general and therefore could recall more details of the procedure regardless of their stress reactivity. This hypothesis was supported by a second study in which greater cortisol during the TSST was positively associated with memory in a sample of 7–15-year-olds and in an adult community sample (Quas, Yim, Rush, & Sumaroka, 2012).

Even less developmental work has focused on the effects of stress on memory retrieval. However, results are generally consistent with adult work and show that greater retrieval stress predicts poorer memory. Quesada, Wiemers, Schoofs, and Wolf (2012) conducted a study in which children 8–10 years old learned the locations of positive, negative, and neutral images on a screen. They were then exposed to the TSST or a non-arousing activity with no social evaluation (the part of the TSST thought to elicit the arousal). Sympathetic activation via salivary alpha-amylase, and HPA activation via cortisol was collected through saliva before and after the task. Not surprisingly, children that took part in the stressful TSST condition showed greater HPA reactivity and performed worse on a delayed retrieval task than children who experienced the non-stressful control task. Importantly, this effect was most pronounced for the negative images. In combination, this work suggests that HPA activation enhances memory consolidation. However, if stress is elicited just before an individual is asked to recall events, memory recall is hindered, likely because arousal at retrieval activates neural regions that facilitate the processing of current emotionally salient information at the cost of using those cognitive resources in a memory search.

If early deprivation is often associated with blunted cortisol reactivity, and greater cortisol reactivity during acute stress is needed for better memory consolidation, early neglect may be associated with later impairments in emotional development, such as the development of anxiety and depressive disorders, through improper encoding of emotional memories. If memories are not accurately stored, a requirement for retrieval, these children may have a difficult time recalling accurate details of their experience, their feelings, and the responses of others involved. This may lead to a greater negative bias when thinking of these events or less information regarding the effectiveness of potential future coping strategies.

In support of this hypothesis, Quas and colleagues (Quas et al., 2016) found that increases in children's and adolescent's cortisol reactivity during the TSST were related to greater accuracy of emotionally valanced words (although only

positive emotional words). Finally, throughout the adult literature, sex-specific effects related to cortisol responses and their association with emotional memory have been demonstrated (e.g., Merz et al., 2010). Developmental work in this area may therefore help elucidate sex-specific differences in pathways toward affective disorders (Goldstein, Jerram, Abbs, Whitfield-Gabrieli, & Makris, 2010).

The Impact of Early Deprivation on Neural Structure and Function Underlying Emotional Development

Infancy and early childhood is characterized by rapid brain development, and neglect during this developmental period can have deleterious effects on brain structure and function. Studies examining the sequelae of early adverse care on emotional development have focused on amygdala structure and its functional connectivity with prefrontal regulatory circuits. Researchers who have investigated the amygdala of previously institutionalized (PI) children have demonstrated enlarged volumes and hyper-responsiveness to threat faces years after removal from institutional care (Mehta et al., 2009; Tottenham et al., 2010; although see Hanson et al., 2015 and Hodel et al., 2015). Relatively little work, however, examines the means through which early adversity influences amygdala structure, function, and its role in children's atypical emotional behavior. We review some of this research below and believe that it provides valuable insight into the specific developmental pathways leading to emotional maladjustment and adaptation.

In one study, Tottenham et al. (2010) used magnetic resonance imaging (MRI) to demonstrate that adoption of PI children after 15 months of age was associated with larger amygdala volumes, poorer performance on an emotional go/no-go task (indicative of poorer emotion regulation), and increased anxiety. In a similar study, these researchers showed that early adverse rearing conditions in infancy were associated with heightened amygdala activity during childhood (Tottenham et al., 2011). Specifically, PI children exhibited heightened amygdala activity relative to the comparison group in response to both fearful faces and distracter stimuli, but not to neutral and target stimuli. Because typically developing children tend to show heightened reactivity to neutral faces, while adults do not (Thomas et al., 2001), the response of the PI children was more "adult-like" and thus might reflect precocious amygdala development.

The fact that the PI children exhibited increased amygdala activity for distracter stimuli relative to the comparison group suggested that the comparison children were better able to ignore the emotional content of the distracter stimuli, while the PI children were not. The authors speculate that this may help explain the greater emotional lability described in PI children (Gunnar, Bruce, & Grotevant, 2000). Interestingly, eye-tracking was also measured and researchers found that higher amygdala responses to faces were associated with less eye contact. Studies in adults suggest that looking in the eye region elicits increasing amygdala activity (Whalen et al., 2004), and may subsequently increase the subjective experience of negative emotion (Lanteaume et al., 2007). Therefore, one way to reduce amygdala activity may be to direct gaze away from arousing stimuli. This hypothesis fits with work assessing gaze aversion as an emotion regulatory strategy in infancy and early childhood (e.g., Hoeksma, Oosterlaan, & Schipper, 2004; Thomas, Letourneau, Campbell, Tomfohr-Madsen, & Giesbrecht, 2017). However, becoming over-aroused in face-to-face interactions, and subsequently minimizing eye contact to regulate that arousal, could have negative consequences for successful social interaction in PI populations.

The amygdala and prefrontal circuitry has also been investigated as it relates to emotional development. Emotional functioning relies on connections between the amygdala and the medial prefrontal cortex (mPFC) (Banks, Eddy, Angstadt, Nathan, & Phan, 2007), and tracing studies suggest that amygdala to PFC projections emerge earlier than PFC to amygdala projections (Bouwmeester, Smits, & Van Ree, 2002). However, how these connections develop across

childhood and adolescence has only recently been explored. For example, one study (Gee et al., 2013) used functional MRI to assess developmental changes in amygdala–prefrontal circuitry across the ages of 4–22 and found positive amygdala–prefrontal connectivity in early childhood (indicative of more immature connectivity) switches to negative functional connectivity (indicative of more mature connectivity) during the transition to adolescence. Moreover, the valence switch related to individual differences in anxiety and behavior during an emotional go/no-go task, over and above the effect of age.

More research is needed regarding the specific pathways involved in amygdala–prefrontal connectivity. However, it could be that early amygdala projections communicate important information about the emotional world and thus facilitate positive connectivity early in development, whereas negative functional connectivity characterized by inhibitory input from the mPFC may discourage communication between the two regions. Thus, amygdala development may drive bottom-up signaling earlier in life such that the amygdala initially signals to the mPFC; over time, top-down signaling from the mPFC emerges. Consistent with this hypothesis is the observation that amygdala-originating inputs to the mPFC come on line earlier than mPFC originating inputs to the amygdala in rodent models (Cressman et al., 2010). Therefore, it was suggested that the developmental switch from positive to negative amygdala–prefrontal connectivity may represent a potential neurobiological basis for the improvements in emotion regulation that have been observed across development.

The previously described work was extended to assess the role of caregiving on amygdala–prefrontal circuitry during childhood (Gee et al., 2014). Children aged 4–10 years old completed an affect-related regulation task while exposed to a picture of their mother and that of a stranger. As they hypothesized, researchers found evidence of maternal buffering, such that when children were being shown the stranger's face, they exhibited more immature (i.e., positive) amygdala–prefrontal connectivity. When shown the mother's face, however, the connectivity was more mature (i.e., negative) and resembled that of an adolescent. Moreover, tests of individual differences demonstrated that greater maternal influence on amygdala–prefrontal circuitry was associated with stronger mother–child relationships and modulation of behavioral regulation. It is expected that young children have access to their caregivers to help them regulate their affect, arousal, and behavior during early childhood. This is not the case during adolescence when regulatory processes are functioning much more independently. Thus, maternal presence may help "trigger" the development of more mature neural connectivity processes as children transition to adolescence and early adulthood. Subsequently, the development of mature amygdala–prefrontal neural circuitry that underlies increased emotion regulation skills may be one neural mechanism through which children gradually transition from almost sole reliance on a caregiver for regulation to increased independence.

If responsive caregiving is expected during early childhood and needed to help form amygdala–prefrontal connections, a natural next question is what happens when children experience early deprivation and are not exposed to responsive caregiving when this circuitry is developing? To test this, Gee and colleagues (2013) examined childhood amygdala–mPFC connections in a sample of PI and comparison children (ages 6.5 to 18) and found that early neglect accelerated the development of amygdala–mPFC connectivity. Unlike the more immature positive amygdala–mPFC coupling seen in comparison children, PI children showed more negative and mature amygdala–mPFC coupling. This connectivity pattern was mediated by cortisol, suggesting that stress-induced modifications of the HPA axis shape amygdala–mPFC circuitry. Thus, it appears that without a sensitive caregiver to buffer amygdala reactivity during early childhood, children experience greater amounts of stress; increased stress may facilitate an earlier coupling of the amygdala and medial prefrontal cortex in an effort to regulate stressful contexts more independently. While that may be an adaptive short-term response to early adversity, we are not aware

of the potential long-term consequences associated with quicker development of this circuitry.

Taken together, this work highlights that early adverse environments that lack sensitive caregivers have a negative influence on early developing biological systems that underlie adaptive emotional development. That is, there is evidence that deficits in physiological and neural mechanisms link early deprivation with subsequent emotional functioning. However, caregiver neglect is also associated with behavioral development underlying emotional competence. This is not to say that behavior functions independently from biology, because we know they are highly interrelated. In the next section, we review work that as provided insight into potential behavioral mechanisms affected by early deprivation that have a negative influence on emotional adjustment.

Early Deprivation and Behavioral Mechanisms Underlying Emotional Functioning

Emotion Regulation

Although the ability to regulate emotion continues to develop into adolescence and early adulthood (e.g., Brenning, Soenens, Van Petegem, & Vansteenkiste, 2015; John & Gross, 2004; Zeman, Cassano, Perry-Parrish, & Stegall, 2006; Zimmermann & Iwanski, 2014), the most rapid gains occur during the first 5 years of life (Kopp, 1982, 1989; Sroufe, 1996). As previously discussed, sensitive and positive emotional interactions with caregivers influence biological mechanisms that facilitate the regulation of emotion. Caregivers can also model appropriate emotional responses and teach children that particular strategies are more useful and appropriate than others when attempting to control emotional displays. For example, regulating attention is thought to be a critical foundational component for the early development of emotion regulation (Rothbart & Sheese, 2007). This is because orienting attention toward a stimulus, or away from it, has the effect of amplifying or reducing the emotional valence with which it is associated, therefore changing the emotional experience and potential salience for the child (Rothbart, Posner, & Rosicky, 1994; Rothbart, Sheese, Rueda, & Posner, 2011). Thus, caregiver interactions that help teach a child that she can reduce arousal by shifting her attention from a toy that she desires but cannot have may help her effectively cope with the frustration resulting from this blocked goal, and subsequently teach her that distraction strategies may be effective in similar situations she encounters on her own. Interestingly, numerous studies show that PI children, who have not experienced consistent social interaction in which these skills are fostered early in life, show attention deficits (e.g., Frenkel et al., 2017; Pollak et al., 2010; Rutter, Kreppner, & O'Connor, 2001), which may contribute to problems self-regulating emotions.

Empirical work shows that early childhood deprivation is associated with poorer emotion regulation across degrees of neglect and developmental time periods. For example, in a sample of PI children adopted between 15 and 34 months and a non-adopted comparison group, Stellern, Esposito, Mliner, Pears, and Gunnar (2014) found that PI children demonstrated more freezing behavior, thought to result from children having fewer skills and resources to deal with increased emotional arousal (Zuddas, 2012), in response to a fear context. In another study, Shipman, Edwards, Brown, Swisher, and Jennings (2005) used a sample of 6–12-year-olds who had experienced neglect (child protective service substantiated) but not physical or sexual abuse within the home. They demonstrated that, compared to their typically developing peers, children experiencing neglect displayed fewer appropriate behavioral displays of emotion as well as lower levels of empathy and emotional self-awareness. Neglected children also reported using fewer adaptive strategies for coping with emotional arousal. In accordance with the hypothesis that neglectful caregivers do not scaffold or teach effective emotion regulation strategies, neglected children reported that they expected less support and more conflict from their mothers in response to their own displays of anger and sadness.

Specifically, neglected children expected their mothers to ignore or punish their negative emotions whereas non-maltreated children expected supportive responses. Not having a sensitive and supportive caregiver to facilitate the development of emotion regulation, as is the case for children who experience early neglect, is particularly disadvantageous for healthy psychological adjustment because deficits in emotion regulation abilities are one mechanism believed to underlie externalizing (e.g., aggression and defiance) and internalizing (e.g., withdrawal, anxiety, and depression) behavior problems.

From a temperament perspective, children's emotional reactivity in combination with their ability to regulate their emotions is critical for developmental outcomes (Rothbart & Bates, 2006). A large body of literature shows that children high in negative affect who also lack the skills to effectively control these intense emotions are more likely to be defiant, act aggressively, and engage in socially inappropriate ways (e.g., Crockenberg, Leerkes, & Jó, 2008; Eisenberg et al., 1996; Eisenberg et al., 2001; Gartstein, Putnam, & Rothbart, 2012). For example, heightened emotional frustration may lead to "emotional blow-ups" characterized by lashing out, hitting, and defying adult requests. However, the occurrence of these "blow-ups" are much less likely when children possess the skills to manage their frustration more appropriately such as seeking caregiver assistance, talking about their feelings, or distracting their attention away from the source of arousal. Over time, the lack of behavioral control of negative emotion may persist into greater externalizing behavior problems in later childhood and adulthood (e.g., Campbell, Shaw, & Gilliom, 2000).

In contrast, overcontrol of emotions, in which children suppress negative affect or focus their attention on the source of arousal, can also be maladaptive and have been linked to higher internalizing behaviors (e.g., Eastabrook, Flynn, & Hollenstein, 2014; Hsieh & Stright, 2012; Hughes, Gullone, & Watson, 2011; Silk, Steinberg, & Morris, 2003). Although the suppression of negative emotion may help children regulate negative arousal in the moment, failure to express negative emotion appropriately, as well as focusing on the source of negative arousal, may exacerbate, and intensify the experience of those emotions, which in turn may lead to greater distress in the form of anxiety or depression (Zeman, Shipman, & Suveg, 2002).

Because children experiencing early neglect and deprivation have trouble regulating their emotions and because poor emotion regulation is a risk factor for psychological maladjustment, we would expect that children with these types of histories would be at risk for internalizing and externalizing disorders. As noted, for children in child protective services who have experienced neglect and other forms of maltreatment, it is typical to find marked elevations in clinically significant levels of behavior and emotional problems (Éthier, Lemelin, & Lacharité, 2004; Manly, Oshri, Lynch, Herzog, & Wortel, 2013; McGee, Wolfe, & Wilson, 1997).

For children adopted out of conditions of deprivation into well-resourced homes, however, this pathway is not as clear. One methodological concern is the informant. Adoptive parents are well-known to report more behavior problems symptoms than are non-adoptive parents and to seek clinical help more readily (Miller et al., 2000). Thus, we need to exercise caution when interpreting differences in symptom reports that are still within the non-disordered range. For example, parents indicated that both internationally adopted children from institutions and those adopted early from foster care exhibited higher internalizing symptoms than did non-adopted comparison children. However, PI but not post-foster care children corroborated their parents' reports (Wiik et al., 2011). Studies focusing on internationally adopted children with clinical levels of internalizing and externalizing problems, notably, have reported no differences in behavior problems from children without histories of neglect and deprivation (e.g., Gunnar & van Dulmen, 2007; Juffer & van Ijzendoorn, 2005; Rutter et al., 2001).

Significant internalizing and externalizing problems do, however, emerge as the child begins to go into and through adolescence (Colvert et al., 2008; Sonuga-Barke, Schlotz, &

Kreppner, 2010). Why this happens is not clear. It could reflect a sleeper effect of early deprivation such that the negative impacts of early adversity are always present but are just not seen until adolescence. On the other hand, it might also be that with adolescence the emotional and social tasks the child must negotiate change and become more complex. Cognitive and emotional problems that parents were able to scaffold and decrease in childhood have now developed beyond what a parent can assist with and therefore interfere severely with the child's successful negotiation of school and friends. More longitudinal work is needed examining the pathways to healthy and impaired emotional functioning for children with histories of early neglect and deprivation.

Emotion Recognition and Facial Processing

Work from the Bucharest Early Intervention Project (BEIP) indicates that in general, the more rudimentary ability to discriminate basic facial emotional expressions early in development is not impaired by institutional care. In their research design, young children who were institutionalized and who have never been institutionalized were recruited. Institutionalized children were then randomly assigned to continued institutional care or high-quality foster-care. Through a series of studies spanning from infancy to age 3.5, researchers utilizing this sample have found few differences in how currently institutionalized children, previously institutionalized children randomly assigned to high-quality foster care, and never institutionalized children discriminate facial emotion.

Nelson, Parker, Guthrie, and the BEIP core group (Nelson, Parker, & Guthrie, 2006) demonstrated that in a sample of 13- to 30-month-old children, institutionalized children performed just as well as never institutionalized children when discriminating between happy, sad, neutral, and fearful faces on a non-verbal visual paired comparison procedure. Moreover, both groups had more difficulty discriminating fear from other faces, which fits with the argument that fear is the last emotional expression to be recognized at an adult level (Thomas, De Bellis, Graham, & LaBar, 2007). Interestingly, when tested at 42 months, after a group of institutionalized children had been randomly assigned to high-quality foster care, the research group still found no observed differences using the same visual task (Jeon, Moulson, Fox, Zeanah, & Nelson, 2010).

The BEIP group also examined the electrophysiological correlates of emotion processing using event-related potentials (ERPs). At a baseline assessment (i.e., before children were randomly placed in foster care), 7- to 32-month-old children were presented with alternating images of happy, sad, fear, and anger faces while ERPs were being recorded. The institutionalized children did show reduced amplitude of all ERP components tested, though the differences were minimal (Parker & Nelson, 2005). When these same children were followed up at 42 months using the same paradigm, children raised in institutions demonstrated cortical hypoarousal (i.e., smaller amplitudes and longer latencies for the occipital ERP P1, N170, and P400 components) compared to children never institutionalized. Despite these differences in ERPs, however, researchers again found no differences in neural processing of facial emotions (Moulson, Fox, Zeanah, & Nelson, 2009).

These findings indicate that young children's ability to discriminate facial expressions of emotions is not severely altered by early deprivation and the experiences they do have with faces may be sufficient to lay the neural architecture required for the development of this skill. Interestingly, however, in a more recent follow-up when children were 8-years-old, researchers did observe deficits among currently institutionalized children in processing facial expressions of emotion both behaviorally and electrophysiologically (Nelson et al., 2013). Specifically, they found that children never experiencing deprivation and children who were placed into high-quality care following deprivation were more accurate at recognizing neutral and fearful faces. The ERP data showed that the P1 ERP component (a component that reflects facial processing)

was biggest for the never institutionalized group, intermediate for the foster-care group, and smallest for the currently institutionalized group. No timing effects were observed, which provided some evidence that children can improve in facial recognition regardless of the age in which they are removed from adverse rearing environments.

Collectively, these studies suggest that there appear to be few differences in the ability to discriminate earlier facial expressions of emotion at earlier ages. As children enter into middle childhood, however, deficits may begin to emerge. This highlights the need for researchers to continue to examine the same individuals over multiple developmental periods to get a more accurate sense of the long-term consequences associated with deprivation that may not be apparent in the short term. Moreover, these findings also suggest that increasing the quality of care children receive can improve their face-processing abilities at both a biological and a behavioral level. The authors acknowledge that neither the ERP nor the behavioral visual comparison tasks used in these studies are measures of more sophisticated social-cognitive understanding of emotion, and whether these children will show deficits in more advanced emotion understanding measures later in development is unknown. In the following section, we review evidence from studies that have used more complex behavioral emotion understanding and affective perspective taking tasks to test where there are deficits in these more advanced skills among children experiencing early neglect.

Emotion Understanding

Emotion understanding refers to the ability to be mindful of your own emotions and to understand the emotions of others (i.e., affective perspective taking). Young children in institutional care, and children who experience significant neglect within the home, have far fewer opportunities to engage in the important face-to-face interactions with caregivers that are necessary in order to teach children about emotions. Children with attentive caregivers are taught to label emotions, read emotional cues, and frequently hear caregivers talk about desires, emotions, thoughts, and beliefs, which all contribute to greater emotional knowledge and comprehension (e.g., Doan & Wang, 2010; Racine, Carpendale, & Turnbull, 2007). Children who experience emotional neglect and are not exposed to these rich emotional dialogues may struggle to understand emotions in comparison to their non-neglected peers.

Although the body of literature is relatively small, there is empirical evidence to support this hypothesis. Fries and Pollak (2004), for example, asked 4- and 5-year-old children to identify photographs of facial expressions of emotion and to match facial expressions to an emotional situation. PI children, relative to their non-adopted peers, had difficulty identifying expressions of emotion and matching appropriate facial expressions to happy, sad, and fearful scenarios. However, PI children did perform just as well as non-adopted children when asked to identify and match angry facial expressions. In a similar study, Camras, Perlman, Fries, and Pollak (2006) demonstrated that preschool-aged PI children performed worse than a non-adopted comparison group on identifying the face matching a stated emotion and on affective perspective taking. In a more recent study examining emotion understanding in PI children, children internationally adopted from foster care, and non-adopted children, Tarullo and colleagues (Tarullo et al., 2016) found that PI children had lower levels of emotion understanding (as indexed by emotion labeling and affective perspective taking tasks) than their non-adopted peers at age 5.5 years. This finding was not explained by children's language ability and was predicted by parents' mental state language (i.e., talk of desires and child's own internal state) at age 3 for the internationally adopted group. Interestingly, in a previous study assessing these associations in 6- and 7-year-olds, researchers did not find differences in emotion understanding for PI and foster children when comparing to their non-adopted peers (Tarullo, Bruce, & Gunnar, 2007). The authors note that at this age period, children were mostly

at ceiling levels on the emotion understanding tasks and that despite being able to eventually acquire these basic competencies, PI children may struggle with more complex understanding of emotion. In combination, this work indicates that, on average, children experiencing early neglect have fewer emotion understanding abilities, and that age of the child, the degree of neglect, and the understanding of specific emotions are important factors to consider when interpreting these associations.

Emotion understanding in typically developing children is associated with greater socioemotional functioning. Children who understand their emotions and the emotions of others are more likable by their peers (Denham, McKinley, Couchoud, & Holt, 1990). Moreover, the increased ability to understand emotions also makes it easier for children to regulate and manage their emotions (Miller et al., 2006). Thus, it is not surprising that a large body of literature has linked decreased emotional understanding to psychological maladjustment including internalizing and externalizing behaviors (Denham et al., 2003; Izard et al., 2001; Trentacosta & Fine, 2010) in typically developing populations. The general idea is that children who misread or do not attend to emotional cues in peer interactions may become socially isolated leading to increased negative emotion and risk for internalizing symptoms (Trentacosta & Fine, 2010). In contrast, perceiving anger or hostility in peer interactions when it is not present may also put children at risk for engaging in externalizing behaviors (Schultz, Izard, & Ackerman, 2000). Because children experiencing early neglect show deficits in the ability to perceive and interpret emotions in themselves and others, emotion understanding may be another mechanism through which early deprivation is associated with psychopathology. Although the work examining the link between emotion understanding and behavior problems is small, a recent study showed that the greater incidence of internalizing and externalizing behaviors demonstrated by PI kids was related to lower levels of emotion understanding (Tarullo et al., 2016).

Conclusions and Future Directions

Early adverse rearing environments characterized by varying degrees of neglect deprive the developing brain from experience-expectant caregiving mechanisms that support optimal development. That is, inadequate caregiving robs the brain of environmental input that facilitates the development of neural and physiological systems underlying emotional functioning, and denies children the important social interactions required to acquire behavioral skills that support emotional competence. We are far from understanding, however, the specific biological and behavioral pathways that link deprivation and emotional health. We do know that the degree of early neglect may impact emotional functioning in diverse ways, as evidenced by different associations that emerge when looking across the type of early adversity and emotional outcomes. Hawk and McCall (2011) demonstrate this in a review of the literature showing that PI children tend to have more internalizing and externalizing emotional symptoms than children in foster care.

We also know that for children experiencing early institutional care, the age at which children are removed from these environments and placed with responsive caregivers often plays a role in the extent to which children experience disruptions in emotional functioning. This is particularly true for the neural and physiological mechanisms underlying emotional development (e.g., Flannery, Giuliani, Flournoy, & Pfeifer, 2017; Tottenham et al., 2010) but is true for behavioral mechanisms involved in the display and regulation of emotion as well (e.g., Hawk & McCall, 2011; Smyke, Zeanah, Fox, Nelson, & Guthrie, 2010). It is therefore imperative to consider the developmental period children are in, as well as how specific emotional processes might change across developmental windows, when aiming to understand associations between early deprivation and emotional adjustment.

The importance of age at which children are removed from deprived environments for emo-

tional development sheds light on the plasticity of biological and behavioral mechanisms underlying emotion. The BEIP core group of researchers provides support for this by demonstrating that children show marked improvements in emotional functioning from a baseline assessment to assessments taken after being placed in high-quality care (e.g., Nelson et al., 2013). Thus, there is continuing plasticity for neurobiological systems underlying risks for emotional maladjustment, but as the length of time children experience inadequate caregiving increases, plasticity likely begins to diminish.

The available data provide some evidence that there may be critical or sensitive periods in early development when different neurobiological systems show greater plasticity and are open to being organized by environmental input. These points in development may provide caregivers greater opportunity to influence developing systems underlying emotional functioning. It will be important to further investigate when these periods emerge, as well as identify specific aspects of early caregiving that are most important in regulating biological systems and fostering emotional behavior.

In doing so, we may identify target areas for intervention and prevention efforts aimed at improving responsivity and sensitivity in individuals providing care for children exposed to various degrees of early deprivation. As evidence of this, Fisher and colleagues have demonstrated that supporting foster parents' ability to provide consistent and supportive care improves the behavioral functioning of preschoolers and may help normalize HPA activity (Fisher, Gunnar, Chamberlain, & Reid, 2000). What is still unclear is what specific parenting behaviors children experiencing early neglect need to foster greater emotional development. It may be the case that a subtler approach is needed; one that gently challenges the child and provides them with the support they need without coming across as overwhelming or demanding (Dozier, 2003). Thus, future work assessing which specific aspects of parenting are most critical will not only greatly increase our knowledge in this area but will also have significant implications for application.

It is also important to acknowledge that gender differences in the association between early deprivation and adjustment are not often assessed. The work that has been done in this area generally reports no gender effects. For example, in a large meta-analysis, Juffer and van Ijzendoorn (2005) found no gender differences in behavior problems or mental health referrals. However, Gunnar and van Dulmen (2007) found that PI boys have more problem behaviors than PI girls. Moreover, Julian and McCall (2016) reported that PI males did not differ from their non-adopted peers in their behavior problems, but PI females had significantly poorer social skills than their non-adopted peers. Thus, future work is needed to better understand whether gender effects emerge when looking at certain types of adjustment, especially social, behavioral, and emotional, after early adversity.

Finally, we do not have a clear picture regarding the effects of early deprivation on long-term emotional functioning. Current data provide some insightful input into these relations but longitudinal studies following the same children into adolescence and early adulthood will be critical. For example, research findings across species (i.e., rodent, monkey, and human) provide evidence of accelerated maturation of emotion circuits and behaviors following early deprivation. In humans, Gee and colleagues (Gee, Gabard-Durnam, et al., 2013, Gee et al., 2013) found that early neglect accelerated the development of amygdala–mPFC connectivity thought to underlie emotion regulation. It is understandable that early maturation of this circuitry may be advantageous for immediate survival given that neglected children must develop mechanisms to independently regulate in the absence of supportive caregiver who can serve as a coregulator. Whether this maturation is beneficial or disadvantageous it is not yet clear. Future translational work is needed to determine the long-term consequences across developmental periods of early deprivation for emotional adjustment and maladjustment.

References

Adam, E. K., Doane, L. D., Zinbarg, R. E., Mineka, S., Craske, M. G., & Griffith, J. W. (2010). Prospective prediction of major depressive disorder from cortisol awakening responses in adolescence. *Psychoneuroendocrinology, 35*(6), 921–931. https://doi.org/10.1016/j.psyneuen.2009.12.007

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5*. Washington, D.C: American Psychiatric Association.

Andreano, J. M., & Cahill, L. (2006). Glucocorticoid release and memory consolidation in men and women. *Psychological Science, 17*(6), 466–470. https://doi.org/10.1111/j.1467-9280.2006.01729.x

Bakermans-Kranenburg, M. J., Steele, H., Zeanah, C. H., Muhamedrahimov, R. J., Vorria, P., Dobrova-Krol, N. A., … Gunnar, M. R. (2011). Children without permanent parents: Research, practice, and policy: III. Attachment and emotional development in institutional care: Characteristics and catch up. *Monographs of the Society for Research in Child Development, 76*(4), 62–91. https://doi.org/10.1111/j.1540-5834.2011.00628.x

Banks, S. J., Eddy, K. T., Angstadt, M., Nathan, P. J., & Phan, K. L. (2007). Amygdala-frontal connectivity during emotion regulation. *Social Cognitive and Affective Neuroscience, 2*(4), 303–312. https://doi.org/10.1093/scan/nsm029

Baram, T. Z., Davis, E. P., Obenaus, A., Sandman, C. A., Small, S. L., Solodkin, A., & Stern, H. (2012). Fragmentation and unpredictability of early-life experience in mental disorders. *American Journal of Psychiatry, 169*, 907–915. https://doi.org/10.1176/appi.ajp.2012.11091347

Barna, I., Bálint, E., Baranyi, J., Bakos, N., Makara, G. B., & Haller, J. (2003). Gender-specific effect of maternal deprivation on anxiety and corticotropin-releasing hormone mRNA expression in rats. *Brain Research Bulletin, 62*(2), 85–91. https://doi.org/10.1016/S0361-9230(03)00216-8

Beebe, B., & Gerstman, L. J. (1980). The 'packaging' of maternal stimulation in relation to infant facial–visual engagement: A case study at four months. *Merrill-Palmer Quarterly, 26*(4), 321–339.

Bernard, K., & Dozier, M. (2010). Examining infants' cortisol responses to laboratory tasks among children varying in attachment disorganization: Stress reactivity or return to baseline? *Developmental Psychology, 46*(6), 1771–1778. https://doi.org/10.1037/a0020660

Bos, K., Zeanah, C. H., Fox, N. A., Drury, S. S., McLaughlin, K. A., & Nelson, C. A. (2011). Psychiatric outcomes in young children with a history of institutionalization. *Harvard Review of Psychiatry, 19*(1), 15–24. https://doi.org/10.3109/10673229.2011.549773

Bouwmeester, H., Smits, K., & Van Ree, J. M. (2002). Neonatal development of projections to the basolateral amygdala from prefrontal and thalamic structures in rat. *Journal of Comparative Neurology, 450*, 241–255. https://doi.org/10.1002/cne.10321

Bowlby, J. (1973). *Attachment and loss. Vol. 2: Separation: Anxiety and anger*. New York, NY: Basic Books.

Bowlby, J. (1988). *A secure base*. New York, NY: Basic Books.

Brenning, K., Soenens, B., Van Petegem, S., & Vansteenkiste, M. (2015). Perceived maternal autonomy support and early adolescent emotion regulation: A longitudinal study. *Social Development, 24*(3), 561–578. https://doi.org/10.1111/sode.12107

Bruce, J., Fisher, P. A., Pears, K. C., & Levine, S. (2009). Morning cortisol levels in preschool-aged foster children: Differential effects of maltreatment type. *Developmental Psychobiology, 51*(1), 14–23. https://doi.org/10.1002/dev.20333

Buchanan, T. W., & Lovallo, W. R. (2001). Enhanced memory for emotional material following stress-level cortisol treatment in humans. *Psychoneuroendocrinology, 26*(3), 307–317. https://doi.org/10.1016/S0306-4530(00)00058-5

Buchanan, T. W., Tranel, D., & Adolphs, R. (2006). Impaired memory retrieval correlates with individual differences in cortisol response but not autonomic response. *Learning & Memory, 13*(3), 382–387. https://doi.org/10.1101/lm.206306

Campbell, S. B., Shaw, D. S., & Gilliom, M. (2000). Early externalizing behavior problems: Toddlers and preschoolers at risk for later maladjustment. *Development and Psychopathology, 12*, 467–488. https://doi.org/10.1017/S0954579400003114

Camras, L. A., Perlman, S. B., Fries, A. W., & Pollak, S. D. (2006). Post-institutionalized Chinese and eastern European children: Heterogeneity in the development of emotion understanding. *International Journal of Behavioral Development, 30*(3), 193–199. https://doi.org/10.1177/0165025406063608

Cohen, R. A., Grieve, S., Hoth, K. F., Paul, R. H., Sweet, L., Tate, D., … Williams, L. M. (2006). Early life stress and morphometry of the adult anterior cingulate cortex and caudate nuclei. *Biological Psychiatry, 59*(10), 975–982. https://doi.org/10.1016/j.biopsych.2005.12.016

Colvert, E., Rutter, M., Beckett, C., Castle, J., Groothues, C., Hawkins, A., … Sonuga-Barke, E. S. (2008). Emotional difficulties in early adolescence following severe early deprivation: Findings from the English and Romanian adoptees study. *Development and Psychopathology, 20*(2), 547–567. https://doi.org/10.1017/S0954579408000278

Cressman, V. L., Balaban, J., Steinfeld, S., Shemyakin, A., Graham, P., Parisot, N., & Moore, H. (2010). Prefrontal cortical inputs to the basal amygdala undergo pruning during late adolescence in the rat. *The Journal of Comparative Neurology, 518*(14), 2693–2709.

Crockenberg, S., Leerkes, E., & Jó, P. (2008). Predicting aggressive behavior in the third year from infant reactivity and regulation as moderated by maternal behavior. *Development and Psychopathology, 20*, 37–54. https://doi.org/10.1017/S0954579408000023

Daskalakis, N. P., Bagot, R. C., Parker, K. J., Vinkers, C. H., & de Kloet, E. R. (2013). The three-hit concept of vulnerability and resilience: Toward understanding adaptation to early-life adversity outcome. *Psychoneuroendocrinology, 38*(9), 1858–1873. https://doi.org/10.1016/j.psyneuen.2013.06.008

De Bellis, M. D. (2005). The psychobiology of neglect. *Child Maltreatment, 10*(2), 150–172. https://doi.org/10.1177/1077559505275116

De Kloet, E. R. (2013). Lifetime achievement from a brain-adrenal perspective: On the CRF-urocortin-glucocorticoid balance. *Journal of Chemical Neuroanatomy, 54*, 42–49. https://doi.org/10.1016/j.jchemneu.2013.10.003

de Quervain, D., Henke, K., Aerni, A., Treyer, V., McGaugh, J. L., Berthold, T., … Hock, C. (2003). Glucocorticoid-induced impairment of declarative memory retrieval is associated with reduced blood flow in the medial temporal lobe. *European Journal of Neuroscience, 17*(6), 1296–1302. https://doi.org/10.1046/j.1460-9568.2003.02542.x

Denham, S. A., Blair, K. A., DeMulder, E., Levitas, J., Sawyer, K., Auerbach-Major, S., & Queenan, P. (2003). Preschool emotional competence: Pathway to social competence. *Child Development, 74*(1), 238–256. https://doi.org/10.1111/1467-8624.00533

Denham, S. A., McKinley, M., Couchoud, E. A., & Holt, R. (1990). Emotional and behavioral predictors of preschool peer ratings. *Child Development, 61*(4), 1145–1152. https://doi.org/10.2307/1130882

Dettling, A. C., Parker, S. W., Lane, S., Sebanc, A., & Gunnar, M. R. (2000). Quality of care and temperament determine changes in cortisol concentrations over the day for young children in childcare. *Psychoneuroendocrinology, 25*(8), 819–836. https://doi.org/10.1016/S0306-4530(00)00028-7

Doan, S. N., & Wang, Q. (2010). Maternal discussions of mental states and behaviors: Relations to emotion situation knowledge in European American and immigrant Chinese children. *Child Development, 81*(5), 1490–1503. https://doi.org/10.1111/j.1467-8624.2010.01487.x

Doom, J. R., & Gunnar, M. R. (2013). Stress physiology and developmental psychopathology: Past, present, and future. *Development and Psychopathology, 25*(4, Pt 2), 1359–1373. https://doi.org/10.1017/S0954579413000667

Dozier, M. (2003). Attachment-based treatment for vulnerable children. *Attachment & Human Development, 5*(3), 253–257. https://doi.org/10.1080/14616730310001596151

Eastabrook, J. M., Flynn, J. J., & Hollenstein, T. (2014). Internalizing symptoms in female adolescents: Associations with emotional awareness and emotion regulation. *Journal of Child and Family Studies, 23*(3), 487–496. https://doi.org/10.1007/s10826-012-9705-y

Eisenberg, N., Cumberland, A., Spinrad, T. L., Fabes, R. A., Shepart, S. A., Reiser, M., … Guthrie, I. K. (2001). The relations of regulation and emotionality to children's externalizing and internalizing problem behavior. *Child Development, 72*, 1112–1134. https://doi.org/10.1111/1467-8624.00337

Eisenberg, N., Fabes, R. A., Guthrie, I. K., Murphy, B. C., Maszk, P., Holmgren, R., & Suh, K. (1996). The relations of regulation and emotionality to problem behavior in elementary school children. *Development and Psychopathology, 8*, 141–162. https://doi.org/10.1017/S095457940000701X

Éthier, L. S., Lemelin, J., & Lacharité, C. (2004). A longitudinal study of the effects of chronic maltreatment on children's behavioral and emotional problems. *Child Abuse & Neglect, 28*(12), 1265–1278. https://doi.org/10.1016/j.chiabu.2004.07.006

Feldman, R., Greenbaum, C. W., & Yirmiya, N. (1999). Mother–infant affect synchrony as an antecedent of the emergence of self-control. *Developmental Psychology, 35*(1), 223–231. https://doi.org/10.1037/0012-1649.35.1.223

Fisher, P. A., Gunnar, M. R., Chamberlain, P., & Reid, J. B. (2000). Preventive intervention for maltreated preschool children: Impact on children's behavior, neuroendocrine activity, and foster parent functioning. *Journal of the American Academy of Child & Adolescent Psychiatry, 39*(11), 1356–1364. https://doi.org/10.1097/00004583-200011000-00009

Flannery, J. E., Giuliani, N. R., Flournoy, J. C., & Pfeifer, J. H. (2017). Neurodevelopmental changes across adolescence in viewing and labeling dynamic peer emotions. *Developmental Cognitive Neuroscience, 25*, 25113–25127. https://doi.org/10.1016/j.dcn.2017.02.003

Frenkel, T. I., Koss, K. J., Donzella, B., Frenn, K. A., Lamm, C., Fox, N. A., & Gunnar, M. R. (2017). ADHD symptoms in post-institutionalized children are partially mediated by altered frontal EEG asymmetry. *Journal of Abnormal Child Psychology, 45*(5), 857–869. https://doi.org/10.1007/s10802-016-0208-y

Fries, A. W., & Pollak, S. D. (2004). Emotion understanding in postinstitutionalized eastern European children. *Development and Psychopathology, 16*(2), 355–369. https://doi.org/10.1017/S0954579404044554

Fries, E., Hesse, J., Hellhammer, J., & Hellhammer, D. H. (2005). A new view on hypocortisolism. *Psychoneuroendocrinology, 30*(10), 1010–1016. https://doi.org/10.1016/j.psyneuen.2005.04.006

Gaab, J., Sonderegger, L., Scherrer, S., & Ehlert, U. (2006). Psychoneuroendocrine effects of cognitive-behavioral stress management in a naturalistic setting-a randomized controlled trial. *Psychoneuroendocrinology, 31*(4), 428–438. https://doi.org/10.1016/j.psyneuen.2005.10.005

Gafford, G. M., & Ressler, K. J. (2015). GABA and NMDA receptors in CRF neurons have opposing effects in fear acquisition and anxiety in central amygdala vs. bed nucleus of the stria terminalis. *Hormones and Behavior, 76*, 136–142. https://doi.org/10.1016/j.yhbeh.2015.04.001

Galatzer-Levy, I. R., Ma, S., Statnikov, A., Yehuda, R., & Shaley, A. Y. (2017). Utilization of machine learning for prediction of post-traumatic stress: A re-

examination of cortisol in the prediction and pathways to non-remitting PTSD. *Translational Psychiatry, 7*(3), 1–8. https://doi.org/10.1038/tp.2017.38

Gartstein, M. A., Putnam, S. P., & Rothbart, M. K. (2012). Etiology of preschool behavior problems: Contributions of temperament attributes in early childhood. *Infant Mental Health Journal, 33*, 197–211. https://doi.org/10.1002/imhj.21312

Gee, D. G., Gabard-Durnam, L., Telzer, E. H., Humphreys, K. L., Goff, B., Shapiro, M., … Tottenham, N. (2014). Maternal buffering of human amygdala-prefrontal circuitry during childhood but not during adolescence. *Psychological Science, 25*(11), 2067–2078. https://doi.org/10.1177/0956797614550878

Gee, D. G., Gabard-Durnam, L. J., Flannery, J., Goff, B., Humphreys, K. L., Telzer, E. H., … Tottenham, N. (2013). Early developmental emergence of human amygdala-prefrontal connectivity after maternal deprivation. *PNAS Proceedings of the National Academy of Sciences of The United States of America, 110*(39), 15638–15643. https://doi.org/10.1073/pnas.1307893110

Gee, D. G., Humphreys, K. L., Flannery, J., Goff, B., Telzer, E. H., Shapiro, M., … Tottenham, N. (2013). A developmental shift from positive to negative connectivity in human amygdala–prefrontal circuitry. *The Journal of Neuroscience, 33*(10), 4584–4593. https://doi.org/10.1523/JNEUROSCI.3446-12.2013

Goldstein, J. M., Jerram, M., Abbs, B., Whitfield-Gabrieli, S., & Makris, N. (2010). Sex differences in stress response circuitry activation dependent on female hormonal cycle. *The Journal of Neuroscience, 30*(2), 431–438. https://doi.org/10.1523/JNEUROSCI.3021-09.2010

Greenough, W. T., Black, J. E., & Wallace, C. S. (1987). Experience and brain development. *Child Development, 58*(3), 539–559. https://doi.org/10.2307/1130197

Gunnar, M., Morison, S. J., Chisholm, K., & Schuder, M. (2001). Salivary cortisol levels in children adopted from Romanian orphanages. *Developmental Psychopatholgy, 13*, 611–628.

Gunnar, M. R. (2017). Social buffering of stress in development: A career perspective. *Perspectives on Psychological Science, 12*(3), 355–373. https://doi.org/10.1177/1745691616680612

Gunnar, M. R., & Adam, E. K. (2012). The hypothalamic-pituitary-adrenocortical system and emotion: Current wisdom and future directions. *Monographs of the Society for Research in Child Development, 77*, 109–119. https://doi.org/10.1111/j.1540-5834.2011.00669.x

Gunnar, M. R., Bruce, J., & Grotevant, H. D. (2000). International adoption of institutionally reared children: Research and policy. *Development and Psychopathology, 12*(4), 677–693. https://doi.org/10.1017/S0954579400004077

Gunnar, M. R., & Cheatham, C. L. (2003). Brain and behavior interfaces: Stress and the developing brain. *Infant Mental Health Journal, 24*(3), 195–211. https://doi.org/10.1002/imhj.10052

Gunnar, M. R., Larson, M. C., Hertsgaard, L., Harris, M. L., & Brodersen, L. (1992). The stressfulness of separation among nine-month-old infants: Effects of social context variables and infant temperament. *Child Development, 63*(2), 290–303. https://doi.org/10.2307/1131479

Gunnar, M. R., & van Dulmen, M. M. (2007). Behavior problems in post-institutionalized internationally adopted children. *Development and Psychopathology, 19*(1), 129–148. https://doi.org/10.1017/S0954579407070071

Gunnar, M. R., & Vazquez, D. M. (2001). Low cortisol and a flattening of expected daytime rhythm: Potential indices of risk in human development. *Development and Psychopathology, 13*(3), 515–538. https://doi.org/10.1017/S0954579401003066

Hanson, J. L., Nacewicz, B. M., Sutterer, M. J., Cayo, A. A., Schaefer, S. M., Rudolph, K. D., … Davidson, R. J. (2015). Behavioral problems after early life stress: Contributions of the hippocampus and amygdala. *Biological Psychiatry, 77*(4), 314–323. https://doi.org/10.1016/j.biopsych.2014.04.020

Hawk, B. N., & McCall, R. B. (2011). Specific extreme behaviors of postinstitutionalized Russian adoptees. *Developmental Psychology, 47*(3), 732–738. https://doi.org/10.1037/a0021108

Heim, C., & Binder, E. B. (2012). Current research trends in early life stress and depression: Review of human studies on sensitive periods, gene-environment interactions, and epigenetics. *Experimental Neurology, 233*, 102–111. https://doi.org/10.1016/j.expneurol.2011.10.032

Heim, C., Ehlert, U., & Hellhammer, D. H. (2000). The potential role of hypocortisolism in the pathophysiology of stress-related bodily disorders. *Psychoneuroendocrinology, 25*(1), 1–35. https://doi.org/10.1016/S0306-4530(99)00035-9

Heim, C., & Nemeroff, C. B. (2001). The role of childhood trauma in the neurobiology of mood and anxiety disorders: Preclinical and clinical studies. *Biological Psychiatry, 49*(12), 1023–1039. https://doi.org/10.1016/S0006-3223(01)01157-X

Heim, C., Owens, M. J., Plotsky, P. M., & Nemeroff, C. B. (1997). Persistent changes in corticotropin-releasing factor systems due to early life stress: Relationship to the pathophysiology of major depression and post-traumatic stress disorder. *Psychopharmacology Bulletin, 33*(2), 185–192.

Hildyard, K. L., & Wolfe, D. A. (2002). Child neglect: Developmental issues and outcomes. *Child Abuse & Neglect, 26*(6–7), 679–695. https://doi.org/10.1016/S0145-2134(02)00341-1

Hodel, A. S., Hunt, R. H., Cowell, R. A., Van Den Heuvel, S. E., Gunnar, M. R., & Thomas, K. M. (2015). Duration of early adversity and structural brain development in post-institutionalized adolescents. *NeuroImage, 105*, 112–119. https://doi.org/10.1016/j.neuroimage.2014.10.020

Hoeksma, J. B., Oosterlaan, J., & Schipper, E. M. (2004). Emotion regulation and the dynamics of feelings: A conceptual and methodological framework. *Child Development, 75*(2), 354–360. https://doi.org/10.1111/j.1467-8624.2004.00677.x

Hofer, M. A. (1973a). The role of nutrition in the physiological and behavioral effects of early maternal separation on infant rats. *Psychosomatic Medicine, 35*(4), 350–359. https://doi.org/10.1097/00006842-197307000-00009

Hofer, M. A. (1973b). Maternal separation affects infant rats' behavior. *Behavioral Biology, 9*(5), 629–633. https://doi.org/10.1016/S0091-6773(73)80057-4

Hofer, M. A. (1994). Hidden regulators in attachment, separation, and loss. *Monographs of the Society for Research in Child Development, 59*(2–3), 192–207. https://doi.org/10.2307/1166146

Hofer, M. A., & Shair, H. (1980). Sensory processes in the control of isolation-induced ultrasonic vocalization by 2-week-old rats. *Journal of Comparative and Physiological Psychology, 94*(2), 271–279. https://doi.org/10.1037/h0077665

Hostinar, C. E., Stellern, S. A., Schaefer, C., Carlson, S. M., & Gunnar, M. R. (2012). Associations between early life adversity and executive function in children adopted internationally from orphanages. *PNAS Proceedings of The National Academy of Sciences of The United States Of America, 109*(Suppl 2), 17,208–17,212. https://doi.org/10.1073/pnas.1121246109

Hsieh, M., & Stright, A. D. (2012). Adolescents emotion regulation strategies, self-concept, and internalizing problems. *Journal of Early Adolescence, 32*, 876–901. https://doi.org/10.1177/0272431611433848

Hughes, E., Gullone, E., & Watson, S. D. (2011). Emotional functioning in children and adolescents with elevated depressive symptoms. *Journal of Psychopathology and Behavioral Assessment, 33*, 335–345. https://doi.org/10.1007/s10862-011-9220-2

Izard, C., Fine, S., Schultz, D., Mostow, A., Ackerman, B., & Youngstrom, E. (2001). Emotion knowledge as a predictor of social behavior and academic competence in children at risk. *Psychological Science, 12*(1), 18–23. https://doi.org/10.1111/1467-9280.00304

Jeon, H., Moulson, M. C., Fox, N., Zeanah, C., & Nelson, C. I. (2010). The effects of early institutionalization on the discrimination of facial expressions of emotion in young children. *Infancy, 15*(2), 209–221. https://doi.org/10.1111/j.1532-7078.2009.00007.x

John, O. P., & Gross, J. J. (2004). Healthy and unhealthy emotion regulation: Personality processes, individual differences, and life span development. *Journal of Personality, 72*(6), 1301–1333. https://doi.org/10.1111/j.1467-6494.2004.00298.x

Juffer, F., & van Ijzendoorn, M. H. (2005). Behavior problems and mental health referrals of international adoptees: A meta-analysis. *Journal of the American Medical Association, 293*(20), 2501–2515. https://doi.org/10.1001/jama.293.20.2501

Julian, M. M., & McCall, R. B. (2016). Social skills in children adopted from socially-emotionally depriving institutions. *Adoption Quarterly, 19*(1), 44–62. https://doi.org/10.1080/10926755.2015.1088106

Kalinichev, M., Easterling, K. W., Plotsky, P. M., & Holtzman, S. G. (2002). Long-lasting changes in stress-induced corticosterone response and anxiety-like behaviors as a consequence of neonatal maternal separation in Long-Evans rats. *Pharmacology, Biochemistry and Behavior, 73*(1), 131–140. https://doi.org/10.1016/S0091-3057(02)00781-5

King, L. S., Colich, N. L., LeMoult, J., Humphreys, K. L., Ordaz, S. J., Price, A. N., & Gotlib, I. H. (2017). The impact of the severity of early life stress on diurnal cortisol: The role of puberty. *Psychoneuroendocrinology*, 7768–7774. https://doi.org/10.1016/j.psyneuen.2016.11.024

Kopp, C. (1982). Antecedents of self-regulation: A developmental perspective. *Developmental Psychology, 18*, 199–214. https://doi.org/10.1037/0012-1649.18.2.199

Kopp, C. (1989). Regulation of distress and negative emotions: A developmental view. *Developmental Psychology, 25*, 243–254. https://doi.org/10.1037/0012-1649.25.3.343

Koss, K. J., Hostinar, C. E., Donzella, B., & Gunnar, M. R. (2014). Social deprivation and the HPA axis in early development. *Psychoneuroendocrinology, 50*, 1–13. https://doi.org/10.1016/j.psyneuen.2014.07.028

Koss, K. J., Mliner, S. B., Donzella, B., & Gunnar, M. R. (2016). Early adversity, hypocortisolism, and behavior problems at school entry: A study of internationally adopted children. *Psychoneuroendocrinology*, 6631–6638. https://doi.org/10.1016/j.psyneuen.2015.12.018

Krugers, H. J., Zhou, M., Joëls, M., & Kindt, M. (2011). Regulation of excitatory synapses and fearful memories by stress hormones. *Frontiers in Behavioral Neuroscience, 5*. https://doi.org/10.3389/fnbeh.2011.00062

Kuhlmann, S., Piel, M., & Wolf, O. T. (2005). Impaired memory retrieval after psychosocial stress in healthy young men. *The Journal of Neuroscience, 25*(11), 2977–2982. https://doi.org/10.1523/JNEUROSCI.5139-04.2005

Kuhlmann, S., & Wolf, O. T. (2006). A non-arousing test situation abolishes the impairing effects of cortisol on delayed memory retrieval in healthy women. *Neuroscience Letters, 22*, 268–272. https://doi.org/10.1016/j.neulet.2006.02.007

Lanteaume, L., Khalfa, S., Régis, J., Marquis, P., Chauvel, P., & Bartolomei, F. (2007). Emotion induction after direct intracerebral stimulations of human amygdala. *Cerebral Cortex, 17*(6), 1307–1313. https://doi.org/10.1093/cercor/bhl041

Levine, S. (1957). Infantile experience and consummatory behavior in adulthood. *Journal of Comparative and Physiological Psychology, 50*(6), 609–612. https://doi.org/10.1037/h0047279

Lionetti, F., Pastore, M., & Barone, L. (2015). Attachment in institutionalized children: A review and meta-analysis. *Child Abuse & Neglect, 42*, 135–145. https://doi.org/10.1016/j.chiabu.2015.02.013

Lopez-Duran, N. L., Kovacs, M., & George, C. J. (2009). Hypothalamic-pituitary-adrenal axis dysregulation in depressed children and adolescents: A meta-analysis. *Psychoneuroendocrinology, 34*(9), 1272–1283. https://doi.org/10.1016/j.psyneuen.2009.03.016

Luijk, M. M., Saridjan, N., Tharner, A., van Ijzendoorn, M. H., Bakermans-Kranenburg, M. J., Jaddoe, V. V., … Tiemeier, H. (2010). Attachment, depression, and cortisol: Deviant patterns in insecure-resistant and disorganized infants. *Developmental Psychobiology, 52*(5), 441–452. https://doi.org/10.1002/dev.20446

Luo, H., Hu, X., Liu, X., Ma, X., Guo, W., Qiu, C., … Li, T. (2012). Hair cortisol level as a biomarker for altered hypothalamic-pituitary-adrenal activity in female adolescents with posttraumatic stress disorder after the 2008 Wenchuan earthquake. *Biological Psychiatry, 72*(1), 65–69. https://doi.org/10.1016/j.biopsych.2011.12.020

Maheu, F. S., Dozier, M., Guyer, A. E., Mandell, D., Peloso, E., Poeth, K., … Ernst, M. (2010). A preliminary study of medial temporal lobe function in youths with a history of caregiver deprivation and emotional neglect. *Cognitive, Affective, & Behavioral Neuroscience, 10*(1), 34–49. https://doi.org/10.3758/CABN.10.1.34

Manly, J. T., Oshri, A., Lynch, M., Herzog, M., & Wortel, S. (2013). Child neglect and the development of externalizing behavior problems: Associations with maternal drug dependence and neighborhood crime. *Child Maltreatment, 18*(1), 17–29. https://doi.org/10.1177/1077559512464119

Mason, W. A., & Berkson, G. (1974). Effects of maternal mobility on the development of rocking and other behaviors rhesus monkeys: A study with artificial mothers. *Developmental Psychobiology, 8*(3), 197–211. https://doi.org/10.1002/dev.420080305

Matthews, K., Wilkinson, L. S., & Robbins, T. W. (1996). Repeated maternal separation of preweanling rats attenuates behavioral responses to primary and conditioned incentives in adulthood. *Physiology & Behavior, 59*(1), 99–107. https://doi.org/10.1016/0031-9384(95)02069-1

McGaugh, J. L., McIntyre, C. K., & Power, A. E. (2002). Amygdala modulation of memory consolidation: Interaction with other brain systems. *Neurobiology of Learning and Memory, 78*(3), 539–552. https://doi.org/10.1006/nlme.2002.4082

McGee, R. A., Wolfe, D. A., & Wilson, S. K. (1997). Multiple maltreatment experiences and adolescent behavior problems: Adolescents' perspectives. *Development and Psychopathology, 9*(1), 131–149. https://doi.org/10.1017/S0954579497001107

McGowan, P. O., Sasaki, A., D'Alessio, A. C., Dymov, S., Labonté, B., Szyf, M., … Meaney, M. J. (2009). Epigenetic regulation of the glucocorticoid receptor in human brain associates with childhood abuse. *Nature Neuroscience, 12*(3), 342–348. https://doi.org/10.1038/nn.2270

McLaughlin, K. A., Sheridan, M. A., Tibu, F., Fox, N. A., Zeanah, C. H., & Nelson, C. I. (2015). Causal effects of the early caregiving environment on development of stress response systems in children. *Proceedings of the National Academy of Sciences of the United States of America, 112*(18), 5637–5642. https://doi.org/10.1073/pnas.1423363112

Mehta, M. A., Golembo, N. I., Nosarti, C., Colvert, E., Mota, A., Williams, S. R., … Sonuga-Barke, E. S. (2009). Amygdala, hippocampal and corpus callosum size following severe early institutional deprivation: The English and Romanian Adoptees study pilot. *Journal of Child Psychology and Psychiatry, 50*(8), 943–951. https://doi.org/10.1111/j.1469-7610.2009.02084.x

Merz, C. J., Tabbert, K., Schweckendiek, J., Klucken, T., Vaitl, D., Stark, R., & Wolf, O. T. (2010). Investigating the impact of sex and cortisol on implicit fear conditioning with fMRI. *Psychoneuroendocrinology, 35*(1), 33–46. https://doi.org/10.1016/j.psyneuen.2009.07.009

Miller, A. L., Fine, S. E., Gouley, K. K., Seifer, R., Dickstein, S., & Shields, A. (2006). Showing and telling about emotions: Interrelations between facets of emotional competence and associations with classroom adjustment in Head Start preschoolers. *Cognition and Emotion, 20*(8), 1170–1192. https://doi.org/10.1080/02699930500405691

Miller, B. C., Fan, X., Grotevant, H. D., Christensen, M., Coyl, D., & van Dulmen, M. (2000). Adopted adolescents' overrepresentation in mental health counseling: Adoptees' problems or parents' lower threshold for referral? *Journal of the American Academy of Child & Adolescent Psychiatry, 39*(12), 1504–1511. https://doi.org/10.1097/00004583-200,012,000-00011

Mineka, S., Gunnar, M. R., & Champoux, M. (1986). Control and early socio-emotional development: Infant Rhesus monkeys reared in controllable vs. uncontrollable environments. *Child Development, 57*, 1241–1256. https://doi.org/10.2307/1130447

Minty, B., & Pattinson, G. (1994). The nature of child neglect. *British Journal of Social Work, 24*(6), 733–747. https://doi.org/10.1093/oxfordjournals.bjsw.a056127.

Moulson, M. C., Fox, N. A., Zeanah, C. H., & Nelson, C. A. (2009). Early adverse experiences and the neurobiology of facial emotion processing. *Developmental Psychology, 45*(1), 17–30. https://doi.org/10.1037/a0014035

Nachmias, M., Gunnar, M., Mangelsdorf, S., Parritz, R. H., & Buss, K. (1996). Behavioral inhibition and stress reactivity: The moderating role of attachment security. *Child Development, 67*(2), 508–522. https://doi.org/10.2307/1131829

National Scientific Council on the Developing Child. (2012). The science of neglect: The persistent absence of responsive care disrupts the developing brain: Working Paper 12. http://www.developingchild.harvard.edu

Naughton, A. M., Maguire, S. A., Mann, M. K., Lumb, R. C., Tempest, V., Gracias, S., & Kemp, A. M. (2013). Emotional, behavioral, and developmen-

tal features indicative of neglect or emotional abuse in preschool children: a systematic review. *JAMA Pediatrics, 167*, 769–775. https://doi.org/10.1001/jamapediatrics.2013.192

Nelson, C. A., Parker, S. W., & Guthrie, D. (2006). The discrimination of facial expressions by typically developing infants and toddlers and those experiencing early institutional care. *Infant Behavior & Development, 29*(2), 210–219. https://doi.org/10.1016/j.infbeh.2005.10.004

Nelson, C. I., Westerlund, A., McDermott, J. M., Zeanah, C. H., & Fox, N. A. (2013). Emotion recognition following early psychosocial deprivation. *Development and Psychopathology, 25*(2), 517–525. https://doi.org/10.1017/S0954579412001216

Parker, S. W., & Nelson, C. A. (2005). The impact of early institutional rearing on the ability to discriminate facial expressions of emotion: An event-related potential study. *Child Development, 76*(1), 54–72. https://doi.org/10.1111/j.1467-8624.2005.00829.x

Pessoa, L. (2017). A network model of the emotional brain. *Trends in Cognitive Sciences, 21*(5), 357–371. https://doi.org/10.1016/j.tics.2017.03.002

Pollak, S. D., Nelson, C. A., Schlaak, M. F., Roeber, B. J., Wewerka, S. S., Wiik, K. L., … Gunnar, M. R. (2010). Neurodevelopmental effects of early deprivation in postinstitutionalized children. *Child Development, 81*(1), 224–236. https://doi.org/10.1111/j.1467-8624.2009.01391.x

Quas, J. A., Bauer, A., & Boyce, W. T. (2004). Physiological Reactivity, Social Support, and Memory in Early Childhood. *Child Development, 75*(3), 797–814. https://doi.org/10.1111/j.1467-8624.2004.00707.x

Quas, J. A., & Klemfuss, J. Z. (2014). Physiological stress reactivity and episodic memory in children. In P. J. Bauer, R. Fivush, P. J. Bauer, & R. Fivush (Eds.), *The Wiley handbook on the development of children's memory* (pp. 688–708). Wiley-Blackwell.

Quas, J. A., Rush, E. B., Yim, I. S., Edelstein, R. S., Otgaar, H., & Smeets, T. (2016). Stress and emotional valence effects on children's versus adolescents' true and false memory. *Memory, 24*(5), 696–707. https://doi.org/10.1080/09658211.2015.1045909

Quas, J. A., Yim, I. S., Edelstein, R. S., Cahill, L., & Rush, E. B. (2011). The role of cortisol reactivity in children's and adults' memory of a prior stressful experience. *Developmental Psychobiology, 53*(2), 166–174. https://doi.org/10.1002/dev.20505

Quas, J. A., Yim, I. S., Rush, E., & Sumaroka, M. (2012). Hypothalamic pituitary adrenal axis and sympathetic activation: Joint predictors of memory in children, adolescents, and adults. *Biological Psychology, 89*(2), 335–341. https://doi.org/10.1016/j.biopsycho.2011.11.006

Quesada, A. A., Wiemers, U. S., Schoofs, D., & Wolf, O. T. (2012). Psychosocial stress exposure impairs memory retrieval in children. *Psychoneuroendocrinology, 37*(1), 125–136. https://doi.org/10.1016/j.psyneuen.2011.05.013

Quevedo, K., Johnson, A. E., Loman, M. L., LaFavor, T. L., & Gunnar, M. (2012). The confluence of adverse early experience and puberty on the cortisol awakening response. *International Journal of Behavioral Development, 36*(1), 19–28. https://doi.org/10.1177/0165025411406860

Racine, T. P., Carpendale, J. M., & Turnbull, W. (2007). Parent-child talk and children's understanding of beliefs and emotions. *Cognition and Emotion, 21*(3), 480–494. https://doi.org/10.1080/02699930600717599

Roozendaal, B., Castello, N. A., Vedana, G., Barsegyan, A., & McGaugh, J. L. (2008). Noradrenergic activation of the basolateral amygdala modulates consolidation of object recognition memory. *Neurobiology of Learning and Memory, 90*(3), 576–579. https://doi.org/10.1016/j.nlm.2008.06.010

Rothbart, M., & Bates, J. (2006). Temperament. In N. Eisenberg, W. Damon, & L. M. Richard (Eds.), *Handbook of child psychology: Vol. 3, Social, emotional and personality development* (6th ed., pp. 99–166). Hoboken, NJ: John Wiley & Sons Inc.

Rothbart, M. K., Posner, M. I., & Rosicky, J. (1994). Orienting in normal and pathological development. *Development and Psychopathology, 6*(4), 635–652. https://doi.org/10.1017/S0954579400004715

Rothbart, M. K., & Sheese, B. E. (2007). Temperament and emotion regulation. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 331–350). New York, NY: Guilford Press.

Rothbart, M. K., Sheese, B. E., Rueda, M. R., & Posner, M. I. (2011). Developing mechanisms of self-regulation in early life. *Emotion Review, 3*(2), 207–213. https://doi.org/10.1177/1754073910387943

Rüedi-Bettschen, D., Zhang, W., Russig, H., Ferger, B., Weston, A., Pedersen, E., … Pryce, C. R. (2006). Early deprivation leads to altered behavioural, autonomic and endocrine responses to environmental challenge in adult Fischer rats. *European Journal of Neuroscience, 24*(10), 2879–2893. https://doi.org/10.1111/j.1460-9568.2006.05158.x

Rutter, M. L., Kreppner, J. M., & O'Connor, T. G. (2001). Specificity and heterogeneity in children's responses to profound institutional privation. *The British Journal of Psychiatry, 17*, 997–103. https://doi.org/10.1192/bjp.179.2.97

Sánchez, M. M., Ladd, C. O., & Plotsky, P. M. (2001). Early adverse experience as a developmental risk factor for later psychopathology: Evidence from rodent and primate models. *Development and Psychopathology, 13*(3), 419–449. https://doi.org/10.1017/S0954579401003029

Schultz, D., Izard, C. E., & Ackerman, B. P. (2000). Children's anger attribution bias: Relations to family environment and social adjustment. *Social Development, 9*(3), 284–301. https://doi.org/10.1111/1467-9507.00126

Shipman, K., Edwards, A., Brown, A., Swisher, L., & Jennings, E. (2005). Managing emotion in a maltreat-

ing context: A pilot study examining child neglect. *Child Abuse & Neglect, 29*(9), 1015–1029. https://doi.org/10.1016/j.chiabu.2005.01.006

Silk, J. S., Steinberg, L., & Morris, A. (2003). Adolescents' emotion regulation in daily life: Links to depressive symptoms and problem behavior. *Child Development, 74*, 1869–1880. https://doi.org/10.1046/j.1467-8624.2003.00643.x

Smeekens, S., Riksen-Walraven, J. M., & van Bakel, H. A. (2007). Multiple determinants of externalizing behavior in 5-year-olds: A longitudinal model. *Journal of Abnormal Child Psychology, 35*(3), 347–361. https://doi.org/10.1007/s10802-006-9095

Smyke, A. T., Zeanah, C. H., Fox, N. A., Nelson, C. A., & Guthrie, D. (2010). Placement in foster care enhances quality of attachment among young institutionalized children. *Child Development, 81*(1), 212–223. https://doi.org/10.1111/j.1467-8624.2009.01390.x

Sonuga-Barke, E. J., Schlotz, W., & Kreppner, J. (2010). Differentiating developmental trajectories for conduct, emotion, and peer problems following early deprivation. *Monographs of the Society for Research in Child Development, 75*(1), 102–124. https://doi.org/10.1111/j.1540-5834.2010.00552.x

Sroufe, L. A. (1989). Relationships, self, and individual adaptation. In A. J. Sameroff & R. N. Emde (Eds.), *Relationship disturbances in early childhood: A developmental approach* (pp. 70–94). New York, NY: Basic Books.

Sroufe, L. A. (1996). *Emotional development: The organization of emotional life in the early years*. New York, NY: Cambridge University Press.

Stellern, S., Esposito, E., Mliner, S., Pears, K., & Gunnar, M. (2014). Increased freezing and decreased positive affect in postinstitutionalized children. *Journal of Child Psychology and Psychiatry, 55*(1), 88–95. https://doi.org/10.1111/jcpp.12123

Strange, B. A., & Dolan, R. J. (2004). β-adrenergic modulation of emotional memory-evoked human amygdala and hippocampal responses. *Proceedings of the National Academy of Sciences of the United States of America, 101*, 11454–11,458. https://doi.org/10.1073/pnas.0404282101

Tarullo, A. R., Bruce, J., & Gunnar, M. R. (2007). False belief and emotion understanding in post-institutionalized children. *Social Development, 16*(1), 57–78. https://doi.org/10.1111/j.1467-9507.2007.00372.x

Tarullo, A. R., & Gunnar, M. R. (2006). Child maltreatment and the developing HPA axis. *Hormones and Behavior, 50*(4), 632–639. https://doi.org/10.1016/j.yhbeh.2006.06.010

Tarullo, A. R., Youssef, A., Frenn, K. A., Wiik, K., Garvin, M. C., & Gunnar, M. R. (2016). Emotion understanding, parent mental state language, and behavior problems in internationally adopted children. *Development and Psychopathology, 28*(2), 371–383. https://doi.org/10.1017/S095457941500111X

The St. Petersburg USA Orphanage Research Team. (2008). The effects of early social-emotional and relationship experience on the development of young orphanage children. *Monographs of the Society for Research in Child Development, 73*(3), vii–295. https://doi.org/10.1111/j.1540-5834.2008.00483.x

Thomas, J. C., Letourneau, N., Campbell, T. S., Tomfohr-Madsen, L., & Giesbrecht, G. F. (2017). Developmental origins of infant emotion regulation: Mediation by temperamental negativity and moderation by maternal sensitivity. *Developmental Psychology, 53*(4), 611–628. https://doi.org/10.1037/dev0000279

Thomas, K. M., Drevets, W. C., Whalen, P. J., Eccard, C. H., Dahl, R. E., Ryan, N. D., & Casey, B. J. (2001). Amygdala response to facial expressions in children and adults. *Biological Psychiatry, 49*(4), 309–316. https://doi.org/10.1016/S0006-3223(00)01066-0

Thomas, L. A., De Bellis, M. D., Graham, R., & LaBar, K. S. (2007). Development of emotional facial recognition in late childhood and adolescence. *Developmental Science, 10*(5), 547–558. https://doi.org/10.1111/j.1467-7687.2007.00614.x

Tottenham, N., Hare, T. A., Millner, A., Gilhooly, T., Zevin, J. D., & Casey, B. J. (2011). Elevated amygdala response to faces following early deprivation. *Developmental Science, 14*(2), 190–204. https://doi.org/10.1111/j.1467-7687.2010.00971.x

Tottenham, N., Hare, T. A., Quinn, B. T., McCarry, T. W., Nurse, M., Gilhooly, T., … Casey, B. J. (2010). Prolonged institutional rearing is associated with atypically large amygdala volume and difficulties in emotion regulation. *Developmental Science, 13*(1), 46–61. https://doi.org/10.1111/j.1467-7687.2009.00852.x

Trentacosta, C. J., & Fine, S. E. (2010). Emotion knowledge, social competence, and behavior problems in childhood and adolescence: A meta-analytic review. *Social Development, 19*(1), 1–29. https://doi.org/10.1111/j.1467-9507.2009.00543.x

Tronick, E. Z., & Gianino, A. (1986). Interactive mismatch and repair: Challenges to the coping infant. *Zero to Three, 6*(3), 1–6.

U.S. Department of Health and Human Services, Administration for Children and Families, Administration on Children, Youth and Families, & Children's Bureau. (2011). Child Maltreatment 2010. http://archive.acf.hhs.gov/programs/cb/pubs/cm10/cm10.pdf

van Ijzendoorn, M. H., Palacios, J., Sonuga-Barke, E. S., Gunnar, M. R., Vorria, P., McCall, R. B., … Juffer, F. (2011). Children without permanent parents: Research, practice, and policy: I. Children in institutional care: Delayed development and resilience. *Monographs of the Society for Research in Child Development, 76*(4), 8–30. https://doi.org/10.1111/j.1540-5834.2011.00626.x

van Stegeren, A. H. (2009). Imaging stress effects on memory: A review of neuroimaging studies. *The Canadian Journal of Psychiatry / La Revue Canadienne De Psychiatrie, 54*(1), 16–27.

van Stegeren, A. H., Wolf, O. T., Everaerd, W., Scheltens, P., Barkhof, F., & Rombouts, S. B. (2007). Endogenous cortisol level interacts with noradrenergic activation in the human amygdala. *Neurobiology of Learning and Memory, 87*(1), 57–66. https://doi.org/10.1016/j.nlm.2006.05.008

Weaver, I. G., Champagne, F. A., Brown, S. E., Dymov, S., Sharma, S., Meaney, M. J., & Szyf, M. (2005). Reversal of maternal programming of stress responses in adult offspring through methyl supplementation: Altering epigenetic marking later in life. *The Journal of Neuroscience, 25*(47), 11,045–11,054. https://doi.org/10.1523/JNEUROSCI.3652-05.2005

Whalen, P. J., Kagan, J., Cook, R. G., Davis, F. C., Kim, H., Polis, S., … Johnstone, T. (2004). Human amygdala responsivity to masked fearful eye whites. *Science, 306*(5704), 2061. https://doi.org/10.1126/science.1103617

Wiik, K. L., Loman, M. M., Van Ryzin, M. J., Armstrong, J. M., Essex, M. J., Pollak, S. D., & Gunnar, M. R. (2011). Behavioral and emotional symptoms of post-institutionalized children in middle childhood. *Journal of Child Psychology and Psychiatry, 52*(1), 56–63. https://doi.org/10.1111/j.1469-7610.2010.02294.x

Zeman, J., Cassano, M., Perry-Parrish, C., & Stegall, S. (2006). Emotion regulation in children and adolescents. *Journal of Developmental and Behavioral Pediatrics, 27*, 155–168.

Zeman, J., Shipman, K., & Suveg, C. (2002). Anger and sadness regulation: Predictions to internalizing and externalizing symptoms in children. *Journal of Clinical Child and Adolescent Psychology, 31*, 393–398. https://doi.org/10.1207/153744202760082658

Zhang, T. Y., Labonté, B., Wen, X. L., Turecki, G., & Meaney, M. J. (2013). Epigenetic mechanisms for the early environmental regulation of hippocampal glucocorticoid receptor gene expression in rodents and humans. *Neuropsychopharmacology, 38*(1), 111–123. https://doi.org/10.1038/npp.2012.149

Zimmermann, P., & Iwanski, A. (2014). Emotion regulation from early adolescence to emerging adulthood and middle adulthood: Age differences, gender differences, and emotion-specific developmental variations. *International Journal of Behavioral Development, 38*(2), 182–194. https://doi.org/10.1177/0165025413515405

Zuddas, A. (2012). A crucial role for basic emotion awareness in the development of emotion regulation? *European Child & Adolescent Psychiatry, 21*(6), 297–299. https://doi.org/10.1007/s00787-012-0283-8

Conclusion: The Future of Emotional Development

Vanessa LoBue, Koraly Pérez-Edgar, and Kristin A. Buss

Abstract

In the concluding chapter of the volume, we reflect on common themes across the chapters and highlight important directions for future research.

By thumbing through the pages of most emotion handbooks, one would guess that *emotional development* is but a small subfield of the larger emotion literature. However, we hope that the chapters in this volume make it clear that emotional development is a unique and independent area of research, complete with its own theories, methodologies, and empirical questions. Here we take the first step of unifying emotional development as a field by bringing together some of its most prominent scientists to review the literature in this domain. Despite the variety of methodologies, approaches, and empirical questions represented here, there were several themes that resonated across chapters to keep in mind for future research in emotional development.

V. LoBue (✉)
Rutgers University—Newark, Department of Psychology, Newark, NJ, USA
e-mail: vlobue@psychology.rutgers.edu

K. Pérez-Edgar · K. A. Buss
The Pennsylvania State University, Department of Psychology, University Park, PA, USA

First, many authors reflected on classic theories of emotion. Some call for modifications based on what we have learned from development, while others outline further clarifications that are still needed. Camras, for example, argues that the conceptualization of emotional expression as a series of automatic outputs is outdated and that we should move forward by embracing a more process-based approach to emotional expression that does not rely on emotional facial expressions as its sole measure. Buss, Cole, Zhou, and several others highlighted the need for a stronger understanding of how emotion is (or is not) distinct from other processes like cognition and emotion regulation (Bardack & Widen; Bell, Wolfe, Diaz, & Liu; Buss, Cole, Zhou; Denham; Hastings & Kahle; Morales & Fox; Pérez-Edgar; Stifter & Augustine). Along the same vein, many of the authors stressed the need for multi-method approaches including both experimental and observational methods, with multiple converging dependent measures, consistent with a process-based approach (Bell, Wolfe, Diaz, & Liu; Beyet & Nelson; Camras; Denham; Hastings & Kahle; LoBue, Kim, & Delgado; Morales & Fox; Pérez-Edgar; Pollack; Spinrad & Eisenberg; Stifter & Augustine; Zeman, Cameron, & Price). Further, Hastings and Kahle suggested that these multi-method approaches should be combined with the use of more sophisticated (nonlinear) techniques for modeling complex processes. Others stressed the specific need for more physiological measures

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6_30

of emotional responding (Hastings & Kahle; Stifter & Augustine) and measures that are appropriate for preverbal infants (Beyet & Nelson; Shablack & Lindquist). Similarly, newer methods that can be used across developmental periods are required so that continuity across the life span can be studied (Bardack & Widen; Dollar & Calkins; Zeman, Cameron, & Price).

Relatedly, several of the authors stressed the need for further research on the mechanisms underlying emotional development across the life span (Burris, Chernenok, Bussey, & Rivera; Dollar & Calkins; Leerkes & Bailes; Malti, Zhang, Myatt, Peplak, & Acland; Morales & Fox; Perry & Gunnar; Harms, Leitzke, & Pollak). A focus on mechanisms will require more longitudinal research that spans developmental time points to determine both continuity and critical periods of change (Burris, Chernenok, Bussey, & Rivera; Dollar & Calkins; LoBue, Kim, & Delgado; Malti, Zhang, Myatt, Peplak, & Acland; Morales & Fox; Pérez-Edgar; Perry & Gunnar; Harms, Leitzke, & Pollak; Shablack & Lindquist), with a particular need for empirical work on older children, adolescents, and adults (Perry & Gunnar; Shablack & Lindquist).

Also consistent with a process-based approach, almost all of the authors acknowledged the need to explore the role of moderators and individual differences that might account for some of the rich variability that is so common of emotional expression (Bardack & Widen; Kiel & Kalomiris; Harms, Leitzke, & Pollak; Pérez-Edgar; Spinrad & Eisenberg). Factors like parenting, attachment, temperament, effortful control, executive function, and language all play an important role in emotional expression at different points in development (Kiel & Kalomiris; LoBue, Kim, & Delgado; Malti, Zhang, Myatt, Peplak, & Acland; Harms, Leitzke, & Pollak; Pons & Harris; Shablack & Lindquist; Stifter & Augustine). Further, many authors emphasized the need for cross-cultural work to explore how socialization might lead to individual differences in emotional responding (Bardack & Widen; Denham; Malti, Zhang, Myatt, Peplak, & Acland; Messinger et al.; Pérez-Edgar; Yang & Wang; Zeman, Cameron, & Price). This work would encompass, for example, how display rules might cause variation in expressive behavior (Camras) or how variations in emotion perception might help us understand the developmental trajectory of emotional understanding (Bayet & Nelson). Other authors echoed the need for further exploration on differences in emotional expression based on gender (Bardack & Widen; Kiel & Kalomiris; Perry & Gunnar; Zeman, Cameron, & Price), parenting relationships outside the mother (e.g., father, grandparents) (Llerkes & Bailes), or variation in the social environment more broadly (Lewis). Likewise, others posited that more research is needed on the similarities and differences between emotion constructs and how emotions might interact with each other or other domains to affect psychological, social, and academic functioning, as well as physical health (Dollar & Calkins; Zeman, Cameron, & Price).

Importantly, several authors suggested that future work should focus on using what we know about emotional development to help parents and healthcare providers offer the best care for infants, children, and adolescents. Rottman, DeJesus, and Greenebaum, for example, outlined in detail the broader implications of basic research on disgust and the role that disgust can potentially play in treating obesity, in encouraging sanitation and hygiene, and even in promoting social justice. Likewise, Spinrad and Eisenberg suggest that we can use research on individual differences in children's sympathy and empathy to help us learn more about the development of in-group/out-group relations or stigma. Further, several researchers point out the possibility of using empirical data to help parents who have children with emotional problems like anxiety and depression (Kiel & Kalomiris) or to encourage parents to capitalize on the systems underlying emotional functioning at different time points in the development in caring for their children (Bell, Wolfe, Diaz, & Liu; Buss, Cole, & Zhou; Perry & Gunnar).

Finally, and perhaps mostly obviously, information gleaned from basic research on emotional development can help inform preventative programs and interventions for children at risk for developing emotional problems (Burris,

Chernenok, Bussey, & Rivera; Palmer, Lakhan-Pal & Cicchetti; Perry & Gunnar). In particular, several researchers point out that while there has been a great deal of research on the development of negative emotions and their behavioral outcomes, there is still very little work on the development of positive emotions (Coe-Odess, Narr, & Allen; Leerkers & Bailes; Messinger et al.; Yang & Wang). This is a particularly important area for future research, as we could potentially use our understanding of the development of positive emotions to build coping strategies for regulating negative ones (Stifter & Augustine).

Altogether, we hope the literature reviewed here presents a starting point for the unification of emotional development as a field and as an inspiration for new and innovative research endeavors in this domain. By coming together, we might 1 day build a cohesive developmental theory of emotional responding that can better inform broader theories of emotion, help with the design of empirical strategies for measuring emotion across the life span, and build practical recommendations about how to foster healthy emotional development in children and families.

Index

V. LoBue et al. (eds.), *Handbook of Emotional Development*,
https://doi.org/10.1007/978-3-030-17332-6

D