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WAIMH Handbook of Infant and Early Childhood Mental Health

Biopsychosocial Factors, Volume One

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Foreword

Volume I of the WAIMH Handbook is a rich, exciting, hopeful, yet, at times, sobering account of what we have learned about infant and early childhood developmental processes, challenges, and trauma within family and broader social contexts as well as the neurobiological underpinnings of human early development and the interconnection with parenting and caregiving families and social structures.

The Social Commission of the United Nations in 1948 was moved to better understand the experiences and needs of homeless children in the world which led to the World Health Organization inviting John Bowlby to research what it was like for children in Europe after the devastation of the Second World War. His important work was published as a monograph (Bowlby, 1952), and later inspired a collection of key papers about parental loss by a number of pioneers in infant mental health (Ainsworth et al. 1962). Since that time, the professional groups which emerged concerned with the psychological and the developmental needs of infants and very young children has continued to grow…in number and diversity. The number of publications on observational and interventional research into the therapeutic needs of stressed and distressed infants and families has grown exponentially.

The First World Congress on Infant Psychiatry was held in Cascais, Portugal in April 1980, and this transdisciplinary Congress led to the formation of the World Association for Infant Psychiatry. The proceedings of that first Congress were published in 1983 as *Frontiers of Infant Psychiatry* (Call et al., 1983). The World Association for Infant Psychiatry became the World Association for Infant Psychiatry and Allied Disciplines in 1985 and later merged with the International Association for Infant Mental Health. The merger of those associations became the World Association for Infant Mental Health in 1992.

Some 40 years after the publication of *Frontiers of Infant Psychiatry,* this book, *The WAIMH Handbook of Infant and Early Childhood Mental Health, Volume 1*, *Biopsychosocial Factors Affecting Infancy and Early Childhood*, takes us on an amazing journey through the inner world, the bio-developmental world, the relationship world, and the broader social world of babies and very young children.

One of the key themes throughout the volume is the importance of seeing infancy and early childhood within the context of the community where the family and child live. Much of the published research about infant and early childhood development has come from Western developed countries.

However, the vast majority of children in our world, the Global Majority, live in countries where family and social structure can be very different, resources for daily living are often sparse, and communities can be surrounded or immersed in civil conflict, poverty, or intermittent natural disasters. On the other hand, for communities to have their own resources and for infant and early childhood professionals, it is our task to advocate and support families to build on their internal and communal resources to do the best that they can for their families and their children.

This volume draws on the diversity of developmental experiences for infants and young children and their families including approaches to understanding the neurobiological components of early human development and relationships all within the social and personal context of parenting and caregiver processes.

The Essential Importance of Play in the Development of the Infant Self

For vulnerable infants and very young children, a key part of their recovery or supported development is to have real and genuine opportunities for play. The opportunity for play is an essential human right for infants, children, and adolescents, and explicitly stated as an essential right in the United Nations Convention on the Rights of the Child. 1989. *Treaty Series* 1577 (November): 3 (Nations, 1989).

Healthy child development requires play as is mentioned by the Office of the United Nations High Commissioner for Human Rights, Convention on the Rights of the Child (General Assembly Resolution 44/25 of 20 November 1989. Available at: www.unhchr.ch/html/menu3/b/k2crc.htm). Further, the American Academy of Pediatrics Clinical Report, with a focus on children in poverty, emphasizes the importance of play for promoting healthy child development and maintaining a strong parent-child bond (Milteer et al., 2012).

In Cox's Bazaar, Bangladesh, there are approximately 320,000 Rohingya refugee children. Erum Mariam (Mariam et al., 2021) and her colleagues from BRAC Humanitarian Play Lab have provided varied and structured opportunities for supported play for refugee young children expelled with their families from Myanmar. The Humanitarian Play Labs provide traditional songs, children's games, and physical activities. In this otherwise terrifying context, the children's play seems to provide a structure of creative and trusting mutual human relationship. Play forms the basis for some hope. One of the key concepts underpinning much of our work in infant and preschool mental health is that of the child's capacity to enjoy play (Slade, 1994).

When we are looking at the experience of the development of infants and very young children, we cannot escape the importance of exploring their experience of play. Play is at the centre of interactions with parents and caregivers, siblings and peers, carers and teachers, strangers and therapists. It is through play that infants and young children learn about the world around them, their relationships, and their own inner experience, self, and identity.

When thinking of children and play, we often think of the older child who has already joined the broader communal peer group at daycare, or when playing with the older siblings or other children in the neighbourhood.

The sixteenth-century painting *Children at Play*, by Pieter Brueghel the Elder, depicts many children and families in a village playing some 80 different games, but there do not seem to be any young infants at play; that is, any infants or toddlers in the state before formal speech. Does this represent a common view that babies might be able to look and babble, but don't know how to play?

Babies and young toddlers do *play* however, and play games; that is, they have playful interactions with others which involve rules, co-operative interactions, expectations, and capacity to demonstrate at least rudimentary understanding about the thoughts of the other who has joined in the game (Reddy, 2008). Play in this context can include games like peekaboo, vocal games, games which involve gentle touch, imitating, and reciprocating facial expressions, cheekily violating the "rules" of to and fro interactional activities, and many more. Babies can demonstrate playful coyness whilst interacting with another and have the capacity to demonstrate.

It is through play that we may have the best lively connection with the child in the before-speech situation. In thinking about play, we are also thinking about relationships between children and adults who may or may not be their carers.

Donald Winnicott wrote much about the importance and experience of play through his creative clinical work with infants, children, adolescents, and adults, that is with people across all ages. He described several features of a child's play which may include intense preoccupation in an interaction with another; the child "manipulates external phenomena in service of the dream and invests chosen external phenomena with dream meaning and feeling."… "Playing implies trust in the environment", and it requires the use of the baby's body to manipulate objects in the world. Play is essentially satisfying and it can be said to reach its own point of saturation; the baby decides when enough is enough. Importantly, playing "is inherently exciting and precarious". Winnicott advised us to invest a lot in the play relationship with infants and children. A child with the capacity to play has some emotional reserve, "room for a symptom or two… no very serious trouble afoot". Play is at the foundation of psychotherapeutic engagement, as it is at the foundation of societal culture.

Winnicott said that "Psychotherapy takes place in the overlap of two areas of playing, that of the patient and that of the therapist. Psychotherapy has to do with two people playing together. The corollary of this is that where playing is not possible then the work done by the therapist is directed towards bringing the patient from a state of not being able to play into a state of being able to play." (Winnicott, 1971) Chapter 3: Playing, A Theoretical Statement).

Here, although play is a serious business, especially in the context of psychotherapy, it should be essentially satisfying. The experience of playful reciprocity involves the development of a sense of trust, epistemic trust, and hope. Trevarthen (2005) focuses on the important experience of play for the infant or young child in the preverbal stages of development.

Over recent decades, we've learned much about the newborn infant in the first months of life, and their capacities for interpersonal engagement and intrinsic capacity for intersubjectivity (Ammaniti & Trentini, Chap. 14, this publication). We become concerned when a very young child is not interested in parents and others close to them, or unable to play. Papoušek has drawn attention to the experience of very young infants who are not able to play and who are withdrawn or intensely distressed or irritable (Papoušek, 2016).

Arrieta Slade (Slade, 1994) states that in helping young children to make meaning through play and pretend, "we can help the child figure out ways to bring these meanings into focus". "Simply playing is among the most valuable clinical tools, for children who lack the ability to make sense of their emotional and social worlds using the tools of representation… playing with another person offers them (the young child) the tools they need within the context of a safe and benign holding environment" (Slade, 1994). Just *playing with* the young child, going along with their play rather than making carefully formulated interpretations, may be the most effective way of helping many young children to understand themselves, their dilemma, and for them to move forward.

In my work as an infant psychiatrist in a tertiary paediatric hospital, our infant mental health team are referred many sick infants and toddlers with medical and surgical problems who may be withdrawn, emotionally shutdown or overtly distressed. Many of their parents also suffer emotional withdrawal or depression, intense anxiety, and at times guilt or despair. Parents may find themselves unable to emotionally connect with their infant or young child, becoming increasingly distant and sad. Working directly with sick infants, parents can sometimes see the emergence of hope of connectedness, where there may have been just despair.

Aisha, aged three years, was referred to an infant mental health service because of her ongoing intense distress, crying and wailing. She was her parents' first child, but her first years had been agonising ones for both parents and, it seemed, for Aisha. Her mother was pregnant again and feeling desperate that there was so little that she or her husband could do to respond to Aisha's constant piercing cry and her distress. They had many consultations with medical specialists and there was a conclusion that Aisha was suffering from a progressive neurological disorder, but one yet without a name. The outlook was bleak for any treatment or improvement in her developmental trajectory. Infant mental health consultation was in part to see whether medication might help Aisha settle. During the consultation Aisha was able to sit only with support from another; however, she was able to look and had some sustained gaze with the therapist in the midst of her crying. Then, one moment Aisha moved her hands briefly from side to side in front of her body in a repetitive sort of way. The therapist smiled, unconsciously, towards Aisha and imitated her hand movements, moving his hands gently back and forth in a similar way. Aisha seemed to watch the therapist watching her and copying her, holding mutual gaze. She had a slight wry smile. The therapist then started to clap slowly and with the same sort of rhythm which matched the movements of Aisha's hands. Aisha then clapped her hands together several times. Her mother seemed shocked and stopped in her tracks; it was as if she had observed something dramatic happening. Indeed, she said, "Aisha has never clapped!" The consultation continued as the parents talked about the pressure placed on their own relationship by the trauma of Aisha's disability, the uncertainty of Aisha's diagnosis, and medical outlook. Although it was difficult to express, there had been a real moment of meeting and of playfulness between Aisha and the therapist which was observed and noted by her parents. In

the next session, they said that the realization that Aisha could clap was a turning point in their relationship with Aisha and between themselves. They now felt there was a way of communicating with Aishia, and that she could reach out to connect. They now had some ideas about her thoughts, wishes, and desires, crucial phenomena which they had thought were absent. They had a way of understanding their daughter, even without language. It seems that joining these moments of playfulness in the midst of despair had allowed for some realistic hope of developing a mutual relationship with their daughter.

Play and playfulness are critical concepts in the process of therapeutic engagement of infants and their families. For Winnicott, the concept of play was at the foundation of his approach to clinical work with infants, and with adults. Play involves somehow recognizing the intentions of the other person and joining with them in interaction, but subtly, and sometimes not so subtly, in reply distorting and modifying how we see the intentions of the other! Playing may involve gentle teasing… and this requires at least an implicit mutual understanding of minds: "I think I know what you're trying to do, but I'm going to do something slightly different".

Conclusion

Infant and early childhood mental health has come an immeasurably long way since before the early investigations and formulations of John Bowlby and the many early WAIPAD pioneers who revealed the fascinating world of infants in family relationships, with their siblings, peers, and communities. This volume impels us forward more decades along our journey into the future of the infant and early childhood experience which is complemented by our understanding of the importance and utility of play in the life of infants, children, and indeed for all of us.

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Preface

In August 2021, we decided to approach the WAIMH Executive Committee proposing the initiation of a new two-volume *WAIMH Handbook of Infant and Early Childhood Mental Health*. The first WAIMH Handbook had been published in 2000, more than 20 years earlier which at that time marked the 20th anniversary of the founding of WAIMH. We want to thank the Executive Committee for their support of our proposal. With the initiation of the second *WAIMH Handbook of Infant and Early Childhood Mental Health*, we were marking the 43rd Anniversary of the founding of WAIMH and planning for the 17th World Congress, that, due to the COVID-19 pandemic, was held part in person and part virtual in Brisbane, Australia. As this two-volume WAIMH Handbook goes to press, we have just completed the very successful 18th WAIMH World Congress in Dublin. The four of us – Hiram Fitzgerald, Miri Keren, Kaija Puura, and I – were enthusiastic about collaborating together as developers, contributors, and editors for this important endeavor for WAIMH.

We want to thank many who have helped us during the process of bringing the Handbook together with two volumes that include six sections: Volume 1 – Infant Development, Neurobiological Influences, Parenting and Caregiving; and Volume 2 – Cultural Context of Parenting and Infant Mental Health, Infancy and Early Childhood Mental Health Assessment, Clinical Infant Mental Health. The editors, all of whom have also contributed chapters, have made much effort to include work in the field of infant and early childhood mental health that is being implemented in different settings around the world. As readers will experience, we have intentionally joined scientific and clinical perspectives as well as policy issues.

In expressions of thanks, we start with the support, encouragement, and interest of the WAIMH Board members from around the world. Next, we want to thank Springer Nature Publishers who have been very supportive from the beginning and throughout this endeavor, showing flexibility when needed and consistent support.

It is important to note, when considering the topic of infant and early childhood mental health at this time, that in August 2021, about a year and a half into the COVID-19 pandemic around the world, we had all been working virtually as in-person meetings were cancelled, and lockdowns and social distancing were imposed for all to ensure the best chances for safety from COVID. We knew that this was a very difficult time for all and were very concerned about the growth and development of infants and young children and the stress that families were feeling, especially those with fewer resources.

Inequities were evident including loss of income and food insecurity combined with more serious illness and deaths for families with fewer resources. And for young children, life had been turned "upside down" with their not being able to be with family or friends. For those old enough, virtual schooling was all that was available if families had the resources to help teach children at home. Further, there was much stress and uncertainty as well as many losses of parents and caregivers which for some families was the only person there for the child.

We feel as editors that it is important to recognize that the world for infants, toddlers, their parents, and caregivers has changed a great deal since the publication of the first WAIMH Handbook in some good ways, but also with many challenges especially in the past 3 years during the COVID-19 pandemic. With closed nurseries and childcare centers, parents being stressed, and parents and caregivers becoming sick, and in some cases dying, the indirect effects on small children could last a lifetime. And the impact has been much greater on those with fewer resources in the first place. As was shared by President Campbell Paul following the successful Dublin Congress and other international meetings that he participated in, young children have been experiencing many uncertainties related to co-existing concerns in addition to the pandemic such as exposure to wars, natural disasters, and other traumatic experiences. As he emphasized, attention needs to be given to how to spread resources in different ways in an effort to reach the most vulnerable children and families around the world.

We also recognize that there have been many positive developments with much increased awareness and knowledge about brain development, infant and early childhood mental health that has been gained since the last WAIMH Handbook was published more than 20 years ago. We have had the opportunity both virtually and more recently with the 2023 Dublin Congress to learn and share this new knowledge. We are hopeful that the development and sharing of the new WAIMH Handbook will also contribute to discussion around the world related to new understanding and ways to help and support the growth of the field. As we did in the first WAIMH Handbook, we again join scientific, clinical, and cultural perspectives with a strong emphasis on policy issues that need to be addressed. We worked diligently to represent knowledge and perspectives from around the world to reflect, as President Campbell Paul stated, the 48 countries and regions that were represented at our 2023 18th World Congress,

JDO – As we shared when we did the first WAIMH Handbook, we are hopeful that this publication will provide further education from around the world about the infant and early childhood mental health field that has grown and developed remarkably since 1992 when WAIMH was formed. I thank the WAIMH Executive Committee for encouraging us do this Handbook and for their many contributions for the book. When writing and editing for the World Association for Infant and Early Childhood Mental Health Handbook, I found myself reflecting on how the field of Infant and Early Childhood Mental Health has grown since I started working in this area, developing one of the first training programs, The Harris Center for Infant Mental Health, and learning from the infants, young children, and their parents and caregivers

while helping them with their problems. I thank the three excellent editors who worked with me on the WAIMH Handbook always offering helpful ideas and the visions that all of them have provided for the field. And of course, I thank my husband, Howard, who has always encouraged me not only with the development and work on this WAIMH Handbook but also throughout my career to develop and follow my interests and passions. I also thank my three children and my six grandchildren with whom I have experienced personally how very important consistent steady relationships are for positive development. Earlier in my career, I studied "emotional availability," that is not just being there physically but being there emotionally to listen to young children. I learned what is important for infant and early childhood mental health – to "be there" when they were upset, to listen when they were ready and want to share, and to be emotionally present to help when help is needed.

HEF – In 1992, when two organizations met in Chicago, merged, and created WAIMH, little did I know that I was launching a 38-year connection to an organization that would take me to 20 countries, diverse cultures, and to friendships that reflected the essence of WAIMH's emphasis on relationship quality. In my personal life, I've had the extraordinary pleasure of observing and participating directly in the lives of 11 babies (3 children, 11 grandchildren), tracking their life course pathways, observing firsthand changes in their behavior styles, and reflecting on the changes in relationship dynamics that occurred in my wife and I as we moved ever deeper into grandparenthood. One of the side-effects of WAIMH is that one develops relationships that extend beyond academic and clinical work, because those of us who work with infants, toddlers, and their families share our own family stories, perhaps more deeply than may happen in other professional associations. So, I thank not only my three co-editors for work on this book, but for their close friendships. I also thank the hundreds of infant mental health colleagues around the world who stepped up to create 61 Affiliate Associations, with at least 1 on every continent, making WAIMH truly a world organization. I especially thank the anchor of my life, my wife Dolores, who not only endured my absences during my 55-year academic career, but managed to participate in it after her retirement from teaching when she became a key administrative assistant for WAIMH, and a constant traveling companion during my 16 years as WAIMH executive director.

MK – I wish to join Dr. Osofsky's thanks to my three co-editors and to all the authors who have accepted our comments and spent additional time at revising their chapters. The uniqueness of this Handbook is its international nature, with a strong emphasis on cultural differences, justice, and equity issues that are so relevant to research and clinical practice in IMH. More personally, I would like to publicly thank my two Palestinian co-authors in the chapter on Parenting in the Middle East, Dr. Ghassan Abdallah and Mrs. Laila Warwar, as the task of writing a chapter together while being in the midst of an ongoing violent geopolitical conflict was a challenge in itself. For me also, being a grandmother of twin girls and two little boys added an affective dimension to my editorship, as I live these processes we write about in this book…such as intergenerational processes, individual variations in development, resilience, and vulnerability. I thank them for their very

existence! Last but not least goes to my husband, who brings to my writings a unique intellectual contribution.

KP – I too wish to warmly thank my three co-editors and all the authors contributing to the Handbook for providing me this unique opportunity to read such a rich collection of chapters from different areas in Infant Mental Health and from different parts of the world. I do hope this Handbook will be of help to researchers, clinicians, and hopefully to policy makers as well. I also wish to thank my co-authors Kevin Nugent and Reija Latva for their contribution – it was a joy to work with you. And finally, I too am thankful of my extended family for all the shared experiences and wonderful moments of playing together with our three grandchildren.

Just as we shared when the first WAIMH Handbook was published, we say again that although we have learned much during the past two decades, these volumes represent steps in our knowledge and not an end to our growth. We hope that the readers will use the Handbook to encourage discussion about the field of infant and early childhood mental health (IECMH). The editors have devoted much of their professional lives to imparting knowledge in this area by establishing training programs so that students and colleagues can learn what is known about IECHM, presenting both within their countries and internationally about IECMH as well as having spent many hours providing clinical services for young children and families. As we shared in our earlier Handbook, we are hopeful that this volume will provoke discussion across disciplines and across national, regional, and cross-cultural boundaries so that we all will understand more about infant and early childhood development, mental health, and ways to support infants, young children, and families. And we are hopeful that this Handbook will provide and expose more of the knowledge that is needed to discuss, share, and hopefully solve some of the difficult issues that infants and young children and families are facing around the world.

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DeWitt, MI, USA — Hiram E. Fitzgerald
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About the Editors

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Hiram E. Fitzgerald, PhD, IMH-E® IV, is University Distinguished Professor Emeritus in the Department of Psychology at Michigan State University. His major areas of research include the study of infant and family development, risk, resilient and adverse childhood experiences, the impact of fathers on early child development, and the etiology of alcohol use disorders. He is past executive director of WAIMH, and is a Fellow of the American Psychological Association, and the Association of Psychological Science. He is a recipient of the designation "Honorary President" of the World Association of Infant Mental Health, and the ZERO to THREE Dolley Madison Lifetime Achievement Award.

Miri Keren, MD, is Associate Clinical Professor in Child and Adolescent Psychiatry at the Bar Ilan University Azrieli Medical School, and WAIMH Honorary President. Her main research interests are about infant psychopathology and diagnoses, eating disorders in infancy, parental psychopathology and parenting, parent-Infant relationships disorders, and PTSD of infancy. As President of the World Association of Infant Mental Health in the years 2012–2016, she has been very invested in the implementation of a declaration of Infant's Rights. In 2000, she founded the Israeli WAIMH Affiliate and is currently its Honorary President, and she is Chairperson of the World Psychiatric Association Perinatal and Infant Mental Health Section. She received the WAIMH Lebovici Award in June 2021.

Kaija Pura, MD, PhD, is Professor of Child Psychiatry in Tampere University, Finland, and Chief Physician in the Department of Child Psychiatry in Tampere University Hospital. She has authored or co-authored over 90 peer-reviewed articles, chapters, and books on assessment and treatment of young children. She is a child mental health expert and advisor for the national children's TV program "Jyrkin ja Neposen kommervenkkejä," an Associate Editor of the *Infant Mental Health Journal,* Executive Director of the World Association for Infant Mental Health, Vice President of the International Association for Child and Adolescent Psychiatry and Allied Professions, and President of the Finnish Association for Child and Adolescent Psychiatry

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Beatrice Beebe PhD, Clinical Professor of Medical Psychology (in Psychiatry), College of Physicians and Surgeons, Columbia University, runs a basic research lab on mother-infant communication at the New York State Psychiatric Institute. Her most recent book is *The Mother-Infant Interaction Picture Book: Origins of Attachment* (Beebe, Cohen & Lachman, Norton, 2016). She has a half-hour internet talk: http://www.aei.org/events/decoding-the-nonverbal-language-of-babies. Her documentary film, Decoding Mother-Infant Interaction: A Story of One Mother and Infant, is on YouTube https://www.youtube.com/watch?v=-60yYJvztJ8&t=2s.

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Tanya Broesch, PhD, graduated from Emory University in 2012 and started a faculty position at Simon Fraser University late that year. Her academic training was in infant social cognition, but she also conducted fieldwork and was trained under an anthropologist, examining social-cognitive development and caregiving across cultures – primarily in Kenya, Fiji, and Vanuatu. Currently, she is Associate Professor of Psychology at Simon Fraser University. Her research focuses on early social cognition, specifically examining caregiving practices and social and emotional development.

Holly E. Brophy-Herb, PhD, is Professor of Child Development at Michigan State University in East Lansing, Michigan. She is Editor of the *Infant Mental Health Journal* and Associate Editor of *Infancy*. Dr. Brophy-Herb's applied research program focuses on early social-emotional development in the context of early relationships in home and childcare/education settings and socialization processes. She is interested in the many influences on emotion socialization processes including interpersonal and intrapersonal processes, familial processes, and contextual characteristics.

Natasha J. Cabrera, PhD, is Professor of Human Development at the University of Maryland. Her research focuses on father involvement and children's social and cognitive development; adaptive and maladaptive factors related to parenting; ethnic and cultural variations in fathering and mothering behaviors; family processes in a social and cultural context and children's development; and the mechanisms that link early experiences to children's school readiness. She is the co-editor of the *Handbook of Father Involvement: Multidisciplinary Perspectives, Second Edition* (Taylor & Francis, 2013).

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Part I

Infant Development

1 Overview: Infant Mental Health Theoretical Perspectives, Research in Social-Emotional and Cognitive Development, and the Importance of Context

Hiram E. Fitzgerald

Infant mental health, an interdisciplinary clinical science field of research and practice, has been defined as, "the developing capacity of the child from birth to age three to experience, regulate and express emotions, form close and secure interpersonal relationships, and explore the environment and learn, all in the context of family, community and cultural expectations for young children" (Parlakian & Siebel 2002). The definition embraces four theoretical perspectives that collectively provide the philosophical foundation of infant mental health as a transdisciplinary field of clinical science: evolutionary theory (Giudice & Ellis, 2016), systems theory (Levin & Fitzgerald, 1992; Overton, 2015) cognitive developmental theory (Piaget, 1952), and psychoanalytic theory (Freud, 1953; see also, Fitzgerald & Barton, 2000; Fitzgerald et al., 2011).

Organization of an Interdisciplinary Field: Theoretical Influences

Evolutionary theory Evolutionary theory draws attention to adaptive changes in behavior because of person–environment interactions with the environment from the moment of conception throughout the life course. While fully embracing genetic influences that comprise the individual's genotype, evolutionary theory shifts attention to the epigenetic and associated phenotypic changes that occur as a result of the individual's adaptation to lived experiences in the moment and over the life course (Buss, 2019).

Systems theory A system is composed of entities that when coupled form a functional whole that generates characteristics not present in its independent parts. Systems are composed of components (parts), bound by feedback structures (relationships), which generate new properties (Levin & Fitzgerald, 1992). When sperm and ovum unite, a new system is formed, an embryo, which contains properties not present in either sperm or ovum. The embryo, therefore, is a new entity, a system, which will generate countless other systems as it differentiates, organizes, and develops in concert with the highly diverse environments it encounters prenatally, and throughout postnatal life.

One crosscutting feature of every individual's life course is change: change produced internally and externally in relation to the individual's encounters with the environment. Systems theory conceptualizes these life-course biopsychosocial adaptive changes as emergent (not pre-ordained), epigenetic (changes in gene expression), dynamic (active), organized (interconnected), constructive

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(self-generative), and hierarchically integrated (von Bertalanffy, 1968; Overton, 2015). Thus, systems theory provides a framework to focus on individual differences in as much as development is viewed as the continuous dynamic interaction of the individual via transactions with others and with diverse social and environmental contexts.

Sameroff (1995) proposed that studying phenotypic (observable) characteristics of the individual requires incorporating environtypic sources of external influences as well as genotypic influences in order to assess the full range of environmental influences on the individual and the family as a whole. In addition, he drew attention to the importance of including the analysis of roles, stories, codes, and rituals when examining relationships within family systems, as key aspects of identity development, intergenerational transmission of culture, and generative of a sense of belongingness and security within the family unit (see Fig. 1.1).

The Adaptive Calibration Model (ACM: Giudice & Ellis, 2016) posits that the adaptive strategies that emerge from genotypic (genetic characteristics) and environtypic interactions contribute to individual differences in life-course phenotypes. According to the ACM, individuals whose early and continuing life-course experiences include secure attachments, predictable caregiving, positive parenting, and social support are posited to have slow life histories that are associated with high levels of resilience and low levels of risk taking. Individuals whose early and continuing life-course experiences include exposure to childhood adversities, parental conflict, high environmental risk (violence, poverty, homelessness, etc.) are posited to have fast life-course histories that are associated with low levels of resilience and high levels of risk taking and risk exposure.

However, because systems nearly always provide both risk and resilience exposure and can change over time, life-course phenotypes can change over time in response to the adaptive demands of new changes in life-course experiences (see Fig. 1.2). Shifts in phenotypes over time reflect the principles of equifinality (different environments can produce similar phenotypes) and multifinality (similar environments can lead to diverse phenotypes). In other words, individuals, families, and communities can change over time, effecting change in the systems in which they are embedded. The degree of change at the individual level will depend on that

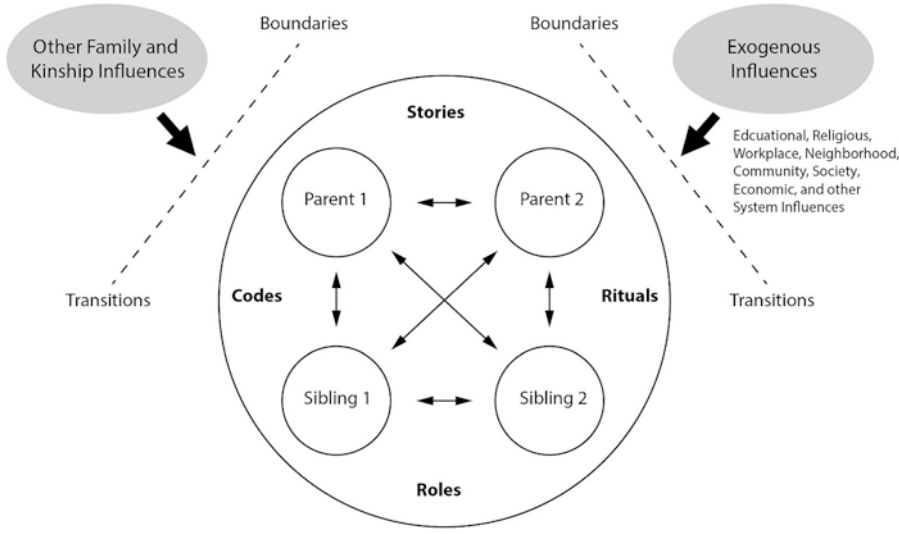

Fig. 1.1 Possible Transactional Linkages in a Two-parent Family System, illustrating family system and exogenous system influences on family dynamics, and Sameroff's (1995) four components of family culture, functions, and identify. (Adapted from Fitzgerald et al. (2020), p. 19)

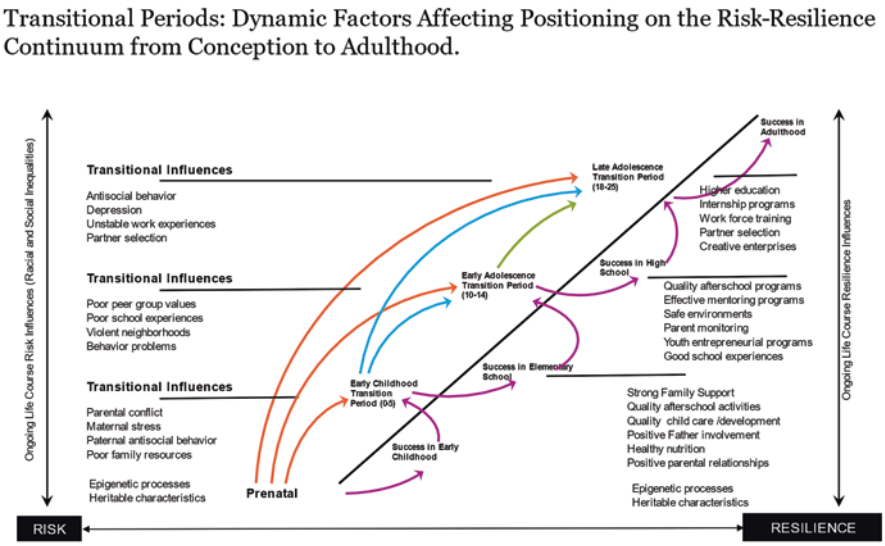

Fig. 1.2 The risk–resilience continuum illustrating transitional dynamic factors risk and resilience influences from conception to adulthood. Transitional periods or switch points on the life course. (Adapted from Fitzgerald (2010), with permission ©Michigan State University Board of Trustees)

individual's unique life-course history along the risk-resilience continuum (Fig. 1.2) and the extent to which the individual is susceptible to environmental influences (Belsky, 2013). Within the context of infant mental health, the implications for preventive-intervention programs and the treatment programs will depend, in part, on the extent to which they reflect trauma-informed care and trauma-informed services (Butler et al., 2011; Harris & Fallot, 2001), and are aligned to cultural contexts (Brown-Rice, 2013; Gone, 2022; Oppong, Brune & Mpofu, 2020; Twizeyemariya et al. 2017).

Cognitive developmental theory Piaget's (1952) intensive observational studies of his 3 children were published during the same Zeitgeist era when both evolutionary psychology and various forms of systems theory were sparking a theoretical transformation from positivist behaviorist mechanistic approaches in human sciences, to more dynamic organismic approaches espoused by systems theory. Piaget described and documented fundamental differences in how children's cognitive understandings of experience change over time such that they fundamentally think differently from one age period to another. In addition, he argued that at any moment in time, in a novel situation, children will be able to assimilate new experiences into their existing mental schema (model) about events or objects, or they will have to change their schema to accommodate to new information. Thus, for Piaget cognitive adaptations and changes in mental representations are governed by adaptive processes in which children are active constructive agents in the change process.

Psychoanalytic theory This era of change in the philosophical foundations of science had a parallel in clinical practice and application as well. For example, psychologists and psychiatrists in the 1930s and 1940s were refocusing psychoanalytic theory of personality toward ego development and function through studies of object relations, development of the self and self-other differentiation, and embracing systems view of interpersonal dynamics (Roiphe, 1979). Rexford et al. (1976) bound systems theory tightly to infant psychiatry, by noting that "this fluid state of adaptation emerges from the continuing adaptations of the various systems involved in organizing the infant's behavior" (p. xvi).

It was during this time as well that Rene Spitz (1965)—sometimes referred to as the founder of "infant psychiatry—drew attention to three infant behaviors that served as organizers in the process of regulating infant–caregiver relationship development: the emergence of the infant's social smile (around 2 months), the emergence of stranger wariness (7–9 months), and the use of the semantic "no" (toddlerhood). All represented child-oriented behaviors prompting social-emotional responses from caregivers. His earlier work revealed profound social withdrawal in neglected institutionalized infants, a phenomenon he described as anaclitic depression, resulting from profound environmental and caregiving neglect. Meanwhile, Selma Fraiberg was teaching parents with blind infants to use touch and auditory sensory experiences to stimulate infants and assist in bringing forth social organizers in the absence of visual cues (Fraiberg, 1974). In 1972, she developed a psychotherapeutic home visiting intervention model ("psychotherapy in the kitchen") designed to strengthen mother–infant relationships, including helping mothers to confront issues from their own rearing that may be interfering with their parenting behavior, issues she referred to as "ghosts in the nursery" (Fraiberg, 1958). Fraiberg's approach stressed a "commitment to the scientific study of infancy; the integration of psychoanalytic theory with the basic data of child development research; an organismic, dynamic view of developmental process; and the conviction that to be maximally effective, the study of infancy must be interdisciplinary" (Fitzgerald, 1985, pps. 37–38).

In summary, the interdisciplinary clinical-science field of infant mental health is fully aligned with the general emphases of applied developmental science: (1) Temporality: ontogenetic and phylogenetic historical embeddedness, (2) Individual differences: diversity in all of its dimensions, (3) Intraindividual change (across the lifespan), (4) Context influences: at all levels of organization, (5) Normative developmental processes, and (6) Bidirectional relationships (within knowledge generation and knowledge application). And, as will be repeatedly noted throughout this volume, for infant mental health researchers, clinicians, and practitioners, there is a foundational principle of infant metal health, namely, relationships matter (Emde & Sameroff, 1989)!

Organization of an Interdisciplinary Profession

In 1983, the Michigan Association for Infant Mental Health developed guidelines concerning the knowledge that all infant mental health specialists should be exposed to regardless of their primary disciplinary training (Fitzgerald, 1985). The committee identified five core knowledge domains: (1) infant development, (2) infant assessment, (3) research methods, (4) clinical skills, and (5) program development and evaluation. The guidelines sparked development of a variety of training programs, including the launch of interdisciplinary graduate programs in infant mental health and/or infant studies through higher education. Forty years later, a sixth category, cultural awareness, has emerged that is inclusive of Indigenous research methods, Indigenous knowledge, and the contemporary and intergenerational impact of historic and race-based trauma on early development (Brown-Rice, 2013).

Papers in this opening section in the Handbook focus on key areas of infant development with respect to social-emotional and cognitive functions of special concern to infant mental health: attention to individual differences, the active role that infant's play in the regulation of caregiver–infant relationships, and contextual influences on phenotypic development. Human infants are biologically primed for engaging the social world into which they are born. Social interactions are set points, or organizers, for social and emotional relationships from which they form mental representations, autobiographical memories, and theories of mind from which they construct their sense of identity, place, and culture. Hill (2022) draws special attention to the importance of the development of sources of resilience that can buffer risk exposure, such as "social connectedness, sense of belonging, agency, optimism, efficacy,

and problem-solving skills" (p. 196). In particular, she notes that "A sense of belonging or a "need to belong" is an indispensable part of being human and undergirds social and cognitive development and is associated with mental and physical health outcomes" (p. 196).

In Chap. 2, Bocknek et al. suggest that the infant's early social and emotional adaptive behaviors play a key role in the development of their sense of belongingness though such programs as the Protect, Promote, and Preserve Framework (Iruka et al., 2021), which includes activities designed to enhance belongingness for Black infants and young children's sense of identity, meaning making, and positive emotions, including Black joy. They draw attention to contemporary models designed to guide research and practice for marginalized children and families that include contextual issues such as historical and contemporary racism, and the role of the family in promoting self and cultural identity through story-telling and rituals and strengthening resilience. They suggest an expansion of research on belongingness to better understand how it serves to enhance social-emotional development and builds resilience in all children whose families are marginalized by the broader society in which they reside (Rana & Lara-Cooper, 2021; Takimoto, Perraza & Armitia, 2023).

We noted Spitz's reference to infant behaviors that served as early organizers of parent–infant relationship development. The very young child's temperamental behavioral style of relating to the environment provides another organizer of early parent-related relationships. Many years ago, Thomas, Chess & Birch, (1968) identified three types of temperament (easy, difficult, and slow to warm up) that affected the quality of infant–caregiver relationships relative to the extent that there was or was not a "goodness of fit" between child and parent temperaments. In Chap. 3, Gartstein, Kirchoff and Lowe provide a contemporary overview of the epigenetic changes during prenatal development that affect brain development and neuroendocrine systems that influence temperament. They note that a deeper understanding of the origins of temperament, and within the concept of goodness of fit, how preventive-intervention programs and services provision can be enhanced within the framework of building better parent–child relationships when the goodness of fit between parent and infant temperaments is challenging and disruptive to the dynamics of family transactions.

In Chap. 4, Coffman et al. provide an overview of the changes in cognitive develop that take place during early childhood, especially to parenting practices that contribute to and enhance cognitive development (book reading, stories, and language), and those that do not (neglect, abuse, limited family resources, and uncertainty). They draw attention to the increasing links between cognitive and brain development to trace the impact of environmental experiences and organizational processes in areas of the brain important to the organization of cognitive and language skills. They note that while attention to parenting and home influences on cognitive develop needs to proceed, parents and families are also affected by the broader ecological contexts within which parent–child relationships occur. Thus, cognitive scientists also examine neighborhood contexts with respect to how they impact directly or indirectly very young children's cognitive development. For example, not enough is known about how contemporary society's emphasis on technology will impact cognitive development in children directly, or via changes in rearing practices involving the increasing availability of artificial intelligence devices used as supplemental caregiving activities. They offer suggestions about how policies and practices need to focus on supporting parenting practices, activities in early childhood centers, and how voices from marginalized populations need to be part of the conversation.

The infant's prelinguistic behaviors provide another avenue to explore the quality of the organization of infant–caregiver interactions, via the ebb and flow of prelinguistic communications. In Chap. 5, Vallotton and Albert provide an overview of how infants and caregivers develop early communications, originally through eye contact and mutual gaze, facial expressions, and gestures, and their integration with infant

vocalizations and caregiver developmental sensitivity to the contingent relationship aspects of turn-taking. Although such interactions may vary across cultures, the extent to which caregivers respond to infant-initiated communications contingently marks the beginning of the synchronous infant–caregiver transitions that will facilitate early speech development and language learning, attentional development and the regulatory aspects of turn-taking. They review characteristics of infant–caregiver transactions that promote and interfere with transitions from infant prelinguistic communications to early language development.

In Chap. 6, Lieberman and Tomlinson draw attention to toddlerhood, a transitional time commonly referred to as the "terrible twos", perhaps an everyday reference to what Spritz described as the "semantic no." While it is the case that children separate from the attachment relationship as they also begin to understand what it means to be an autonomous being, they also have apprehensions about losing emotional ties to their loved ones. So, in addition to a surge in independence and ego-centeredness, toddlerhood also is a time of apprehension. The authors address one some of the motivational features of toddlerhood related to the emergence of autonomy: fear. Fear of separation and loss, fear of losing love, body damage, or of being bad, all of which are linked to the quality of the child's attachment relationship. Parent–child relationships related to such fears will vary on the quality of parent–child temperament goodness of fit, the child's level of cognitive development, and the overall quality of parenting practices, family life and other influences. Overall, the transition period from infancy to preschool age is marked by significant psychology and biological change that can challenge parent–child relationships, as well as the quality of prevention and intervention programs. Among factors to take into consideration are sex differences in rate of maturational change between boys and girls, which may lead to differential susceptibility to prevention and intervention programs.

Throughout the world, millions of children have daily experiences with caregivers other than their parents, through government-supported programs such as Early Head Start and Head Start in the United States and Early Start in the United Kingdom, public or private day care centers, and preschools, family day care, orphanages, and other group settings. In some instances, such programs are funded by federal government agencies, and in other cases they are funded at more local levels, by government and by parents. When such programs have high-quality teachers, resources, facilities and support staff, evidence clearly indicates that children can thrive cognitively, emotionally, and in social competence. In Chap. 7, Calcott, Reid and Gilliam describe challenges for high-quality care provision in many childcare settings, including underpaid and overworked teachers, lack of adequate resources to promote educational success, large class sizes, poor family resources, and families who have difficulty accessing centers. In addition, children who attend out of home child will have diverse prior experiences with educational activities, interactions with multiple caregivers, and diverse temperaments and behavioral styles. Calcott et al. draw attention to stress-related difficulties in children in childcare, note the exacerbation of stress in children and teachers throughout the COVID-19 pandemic, and the collective impact on the childcare experience. They note that children exposed to adverse experiences are especially challenged to have successful experiences. Boys lag girls in their rates of maturation, are more likely to respond to stress by acting aggressively (Golding & Fitzgerald, 2019), and are more at risk of having problems related to self-regulation. Calcott et al. point out one consequence of teacher and environmental stress is that boys are more likely to be expelled from childcare classrooms than are girls, as are children from marginalized families. They note that negative early childcare experiences can have a continuing effect on such children.

In Part I of this volume, we have introduced dynamic systems theory as the macro theoretical stance underpinning the WAIMH Handbooks, and focused attention to individual differences in behavioral phenotypes and contextual influences on the children's "goodness of fit" with their

unique lived experiences. But there is another dimension to phenotype as the term historically applied to observed characteristics of the individual as distinct from genotype, namely, that science now enables many biological processes to be included in the observed characteristics frame, because today we can also observe brain function, scan blood flow, measure hormones, and observe structural anomalies of functioning organ systems.

In Part II, we examine biological processes that contribute to phenotypic diversity, and neurobiological/neuroendocrinological processes that through organizational processes become embedded into the system to mediate or moderate the individual's unique phenotype, and conclude with a discussion of intersubjectivity, an integrative framework for understanding self, and self-other relationships.

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2 Belongingness as the Foundation of Social and Emotional Development: Focus on Black Infants, Toddlers, and Young Children

Erika London Bocknek, Iheoma U. Iruka, Holly E. Brophy-Herb, Kimberly Stokes, and Ana L. Johnson

Infant and early childhood mental health scientists and practitioners have long emphasized the power of relationship quality in social and emotional health and well-being. To this end, relationship quality is directly or indirectly linked to a variety of social and emotional outcomes, including attachment, peer social skills, prosocial behaviors, and social problem-solving. Yet, the belongingness that is embedded in and flows from relationships is less often described as an overarching driving force in social and emotional development for infants, toddlers, and young children. Belongingness is the sense of a deep mutual connection with others and environments that include individuals, groups, and social systems; identities (racial and cultural identities, gender identities, etc.); shared collective experiences in the past, present, and future; and the larger world (e.g., Allen et al., 2021). Theories describing belongingness underscore the mutuality through which individuals feel they can impact and are impacted by their environments. Belongingness is theorized to be a fundamental driver of all human activity because establishing oneself as inextricable in one's networks is at the heart of human survival and human thriving. It is a key element in physical, psychological, and relational safety. Moreover, a sense of belongingness underscores the reason that any area of social and emotional development matters. Specifically, social and emotional processes help children achieve belongingness in a given environment. For example, infants engage in reciprocal and complex communication with important others that are socially mediated, like primary caregivers, creating a shared language to communicate that is meaningful in context and influenced by both infant and caregiver. Belongingness speaks both to the motivation and the force through which repeated interactions in any relationship are maintained.

There are many examples of processes that contribute to children's growing sense of belongingness. In infancy, children develop a transactional dance with their caregivers and others to

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establish patterns and rules in relationships that each partner can know, impact, and draw from. In infancy and toddlerhood, children are demonstrating intersubjectivity and deriving representational meanings about themselves and their world via their interactions with others. In toddlerhood and the early preschool years, young children engage in the symbolic world and rule-based thinking in order to connect to and impact their expanding social worlds and meaningfully belong. They adopt routines as a demonstration of their eagerness to embrace social and contextual rules that define shared identity and belongingness. Children's sense of selfhood, rooted in the intersubjective self-other perspective, develops by utilizing emotional information that dynamically regulates how children respond to and join their social environments. To understand belongingness as core to human development is to understand the meaning of the social and emotional processes that help children achieve belongingness for protection, promotion, and preservation of self and community. The purpose of this chapter is to explore key social and emotional processes that promote belongingness.

While belongingness is core to development for all children, we specifically center the belongingness of Black[1] infants, toddlers, and preschoolers. Black children, along with other children who are marginalized in their societies, collectively represent the global majority of children who share a context of multi-level racism. Racism is the greatest risk to belongingness experienced in the places they live. In fact, scholarship on colonialism highlights the role of past and current systemic racism in societies around the world (Woodson & Love, 2020). Systemic racism is not just a layer of potential trauma, or additive trauma within a possible list of adversities, but is an *organizer of experience and context* for Black children, like other children who develop in societies not created for them. However, while there are shared experiences among children who are marginalized in their societies, such experiences are not experienced by all groups in the same way. Therefore, we intentionally center a meaningful inquiry into the development of Black infants, toddlers, and young children. From this perspective, we expect that additional papers can extend this work, generating focused inquiry with other populations and considering the role of person–environment context for social and emotional facilitators of belongingness.

Social psychologists Clark and Clark challenged the public schools' *separate but equal* doctrine in the 1940s, affirming that racism, experienced through multiple levels of society, is traumatic for Black children. Nearly 80 years later, we continue to raise this clarion call; Black children face the perniciousness of anti-Black racism as trauma in societies around the world. Black children, worldwide, face the greatest impacts of colonialism and violence, and historical trauma meaningfully impacts early development (Fitzgerald et al., 2021). In our own field, being Black is frequently labeled by researchers as a risk factor (rather than naming racism as the risk), and Black families are likely to be described as maladaptive or dysfunctional (rather than naming structural racism at the core of collective forces that create and maintain dysfunction in the lives of Black children and their families). As a result of this type of racism shaping narratives and approaches to early development, Black children are at the greatest likelihood of being deficit-framed by historical and contemporary scholarship. One explanation for this consistent practice, or tool that maintains it, is that social and emotional development is often conceptualized as a universal set of traits, states, and behaviors without context. For example, the field has come to embrace the idea that, generally, a calm behavioral presentation represents high social

[1]We intentionally use this term that describes race so that we meaningfully center a diverse group of people who are impacted by anti-Black racism. We adapt the following definition of this term (Iruka et al., 2021b). We use the term "Black" as a pan-ethnic description of anyone having any ancestral heritage from Africa. This includes anyone who identifies as descended from enslaved persons in their countries of residence and citizenship and anyone who identifies as Black African or Afro-Caribbean. "Black" also includes those who report being Black alone or in combination with one or more races or ethnicities in their responses to reporting agencies, like census data collection, such as Afro-Latine.

and emotional competence. However, underreacting to stressful stimuli can be as much a representation of risk as can overreacting. Bias impacts the interpretation of children's behaviors; determining what kind of an emotional response is an environmental match is a highly subjective matter. When we start, first, with belongingness as foundational, we can then ask what facilitates belongingness in any given environment. In doing so, belongingness not only reflects adherence to the social rules in that environment or relationship, but belongingness involves a depth of mutuality that facilitates ongoing capacity for growth. Moreover, research shows that developmental underpinnings of the social infant and foundations of the drive for belongingness can be traced as early as fetal development (see Ammaniti & Trentini, Chap. 14, this volume).

Based on social identity mapping (Jacobson & Mustafa, 2019), we critically contextualize our own thinking and approach to this work. The second author who has traits of privilege, similar to all authors, (i.e., cis-gender, English-speaking, U.S. born citizen, able-bodied, heterosexual, married, and middle class) also has intersecting identities often viewed as a disadvantage in White normative spaces, which include Black diasporic identity as a first-generation Nigerian, non-identified, dual language learner, and grew up in low-income household and community. The first and third authors share many positionality traits that have promoted privilege across many contexts, including race (White[2]), gender (female), class (middle), citizenship (U.S.-born), ability status (able), sexual orientation (heterosexual and married), and gender identity (cis-gender). The fourth author holds traits of perceived societal privilege that align with the other authors (i.e., cis-gender, English-speaking, U.S.-born citizen, able-bodied, heterosexual, college-educated, and middle-class) alongside intersectional identities of pride as a Black American woman. Similarly, the fifth author identifies characteristics of perceived societal status such as cis-gender, English-speaking, U.S.-born citizen, able-bodied, heterosexual, college-educated, and middle-class, as well as intersectional identities of pride as a Black woman. This collection of positionality, as well as the nature of the shared statuses among authors in varying ways, contributes to an opportunity to learn from one another, and to a privileged gaze for which we attempted to be responsive to in two ways. First, we adopted a curious stance to our own ideas and writing, in collaboration with co-authors, and towards the literature we reviewed. Second, we sought to maintain a reflective orientation to co-author conversations and have developed a relational history of flexible thinking. Third, we view this work as an opportunity to join an ongoing conversation that began before us, is progressing in parallel around us, and will continue beyond this work.

Black Children's Social and Emotional Development

One may experience varying levels of belongingness in different environments or based on varying relationships. Stone (2018) defines belongingness as related to coherence among personal identity, group attachment, and cultural background. Children develop an overall sense of their belongingness, based on dynamic, transactional, repeated experiences of belongingness. Together, these experiences integrate into a given child's self-concept and predict their behaviors in the present and in the future (Cameron & Granger, 2020). To our knowledge, belongingness is not studied as such, or named as such, in the academic literature during the period of infancy and toddlerhood. The Piagetian view that very young children are egocentric, or unable to adopt another person's point of view, continues to be a

[2]The racial term describe *White* refers primarily to persons with European ancestry and ancestral histories of colonization of other communities. However, because whiteness as a construct was never intended to describe skin color alone, we explicitly name that White racial identity is rarely used as a marker of country or continent of origin but rather denotes the normalizing of a dominant group of actors who create and benefit from a shared power structure and who use that power structure to maintain dominance over others.

pervasive idea in how young children are often viewed. However, infant mental health theory and scholarship emphasize the young infant's social engagement in early primary relationships. Further, research regarding the development of intersubjectivity supports the idea that infants integrate their awareness of the environment beyond the primary dyad in the first year (for review, see Ammaniti & Trentini, Chap. 14, this volume). Belongingness is essential to all aspects of development such that it inherently must be an organizing developmental phenomena emerging in the earliest time of life.

Belongingness is also sociopolitically contextualized. Bonilla-Silva (2019, p. 2) notes that children "feel race" very early through affective attunement in their environments and the nature of race as intersubjectively defined. Infants' transactional interactions with caregivers involve processing verbal and non-verbal communication and protocommunication, evolving with complexity in the ways experiences are processed, and generating the infant's sense of self that includes the categorical ("I have curly hair.") and the existential ("I am Black with a community history of belonging.") (Ammaniti & Gallese, 2014). That is, one must acknowledge power dynamics in human systems that impact both the possibility for belongingness to be achieved and also circumscribe this dance within which infants move from being to becoming, the development of which is motivated by the drive for belongingness. Infants can *feel* environments in which their own humanity is celebrated, not denied or tolerated. Stone (2018) writes, "… 'belonging' (as opposed to 'belonging to') is experienced as an embodied sense of control, comfort and security; the ease through which one can convey both socially constructed and self-conceived identities" (p. 4). Njoroge et al. (2009) discuss the salience of infants' awareness of social relationships, calibration of behaviors based on contingent responses, and the evidence for sharing mental states as affirmation of very young children's engagement in self-other understanding and the potential to "feel race." Furthermore, the embeddedness of the infants in their primary caregiving relationships buffers the impacts of racism, as threat to belongingness, through pro-Black environments. as homeplaces. Homeplaces, according to hooks (2007), are "where we can be affirmed in our minds and hearts … where we could restore ourselves the dignity denied us on the outside in the public world". Homeplaces shape belongingness for young children through their own early experiences and through their trusted adults' experiences in mutual and dynamic interactions.

Hill (2022) writes, "…historical and racial trauma have attempted to destroy both the physical and psychological homeplace of people of color, and [the work of multiple scholars documents] the lengths families and communities take to hold onto and reestablish a sense of homeplace and belonging for their communities, families, and children" (p. 197). Research with primarily older children describes risks to belongingness, via racist persons and environments, tasking Black children with social and emotional skills specific to maintaining belongingness, such as proactively employing positive self-appraisal (Montoro et al., 2021). In addition, families and communities, including early childhood environments, play critical roles in promoting children's sense of belongingness through positive racial/ethnic identity socialization within nurturing relationships as a whole. All together, we suggest that the processes and behaviors that meaningfully matter for Black children to achieve belongingness are the development of intersubjectivity, children's knowledge and awareness of shared and separate mental states and experiences; children's capacities for meaning-making through which they make sense of their sometimes conflicting worlds, their relationships to self and other in those worlds and in the intersubjective spaces between; and emotional regulation through which they understand and interpret emotional information about the environments to which they belong.

Intersubjectivity

In infancy, intersubjectivity is expressed through reciprocal interactions characterized by behaviors such as shared eye contact or mutual

expressions of aligned movement or energy (all of which are culturally embedded and defined, and hence, differ in varying cultural contexts) and intentional communication with others. In toddlerhood, intersubjectivity often reflects the child's awareness of the larger social context, such as an awareness of family routines and rituals, and a growing integration of societal messages about position-based characteristics. Western psychologists have described intersubjectivity as the foundation of empathy development through which belongingness is achieved (see Ammaniti & Trentini, Chap. 14, this volume). Such thinking has existed for much longer in non-Western spheres, including African philosophies like Ubuntu. Within this philosophy, being and belonging do not stand in contrast to one another but rather are shaped together through intersubjective spaces (Hogue, 2017).

There are many ways in which early infant behaviors reflect emerging intersubjectivity and a drive toward belongingness. For example, preverbal infants demonstrate a visual preference for (e.g., see Hamlin & Sitch, 2020; Tan & Hamlin, 2022; Hamlin et al., 2007) and a neurological reflection of (Gredebäck et al., 2015) the social perception of helping versus hindering acts. Similarly, 16-month-old infants (research primarily conducted with white children) are more likely to select novel food that matches the preference of an actor (puppet), demonstrating empathy (Hamlin & Wynn, 2012). Researchers often explain results like these as illustrating early sociomoral evaluations among young infants (e.g., Hamlin, 2013) and the influence of cultural socialization and teaching among samples of older infants and toddlers (Hamlin & Wynn, 2012). Remarkably, the drive toward belongingness via prosociality and investment in the well-being of the group is seen across human societies around the world and across many other animal species as well (Narvaez & Bradshaw, 2023). Rather than reflecting an innate understanding of socially constructed rules about morality, these observations are consistent with a perspective that infants and toddlers are seeking to understand and integrate other people's subjective states with their own in a quest for belongingness, or, as Trevarthen and Aitken (2001) have described it, "ability of persons to act together and to share experience in harmony" (p. 5).

Race, culture, and ethnicity are often used in overlapping ways, but race refers to a sociopolitical designation based on skin color and other visible differences, culture refers to a shared system of meaning, including values and language, and ethnicity refers to an individual child's developing sense of their identity within a cultural community (Njoroge et al., 2009). The latter is subjective, while the first two are externally imposed, and serves as context of self-other development. Black children often navigate conflicting cultural environments between that of their families and communities and that of the dominant supremacist society with which they interact with as early as during fetal development and then throughout the lifespan, including experiences during pregnancy that impact both maternal and fetal health (Chambers et al., 2021). Meaning about how infants, toddlers, and young children belong is shaped through racial pride and identity socialization as well by the racism that impacts children's development: for example, in how healthcare is delivered to their pregnant parents, how educational environments interact with the growing child, and how housing injustices impact family wellness. Social and emotional development in these contexts includes the developmental maturation of intersubjectivity through which Black children experience micro- and macro-level interactions between themselves and each intersecting layer of their ecologies, and or in triadic interactions between themselves, their caregivers, and other social environments. At a very young age, Black children come to understand the overt and covert messages regarding White-centered preferences about race as well as Black-centered perspectives on race. From the perspective of racial socialization, intersubjectivity aligns with a protective and appropriate assessment of risk, as well as the integrated need for defined selfhood (Anderson & Stevenson, 2019). In fact, studies that show that young infants (as early as 3 months of age) prefer the faces of "in-group" persons and that toddlers use positionality and physical

characteristics to make choices about social behavior. If we falsely assume that infants and toddlers are egocentric, these behaviors appear to point to young children as prone to apathy or ignorance without intervention. However, if we acknowledge that belongingness is an organizing development phenomenon driving development across domains and that infants are innately social, findings like these show the very early presence of affiliative behaviors that seek community-based belonging. For this reason, color-evasive approaches to programming and environments are not developmentally informed; rather, color-conscious approaches build on children's early, growing intersubjectivity in prosocial ways.

Studies show that, early in the preschool period, Black children are aware of societal preferences for whiteness and may select a white doll over a Black doll as the preferable toy, though contemporary scholarship has called into question methodological biases problematizing interpretation (Burnett & Sisson, 1995). Spencer (1983) discusses this well-known research as reflective of Black children's understanding of broader societal biases, though they do not necessarily endorse those biases themselves or internalize such biases. Rather, they are naming what they believe is the "right" answer to give to the researcher and reflecting the ways that complex and unfolding intersubjectivity promotes safety and belongingness in a given environment. Early childhood scholars have built upon DuBois' principle of "double consciousness", or the struggle that Black people face as they preserve their cultural identity but also remain true to the demands of the dominant White culture. Young children develop this double consciousness early, via growing intersubjectivity, and there is evidence of the ways it can impair social and emotional development through "frustrated play" (Broughton, 2022). "Frustrated play" refers to the constraining play Black children may engage in in contexts of racism, evident in the environment and/or impacting their families and communities through the evidence of systemic inequities. Broughton (2022) describes it, for example, as a Black child given only White superhero figures to play with during what should be an opportunity for expansive and imaginative play. Because play is known to be important for children in facilitating social and emotional development, disruption in conflicting person–environment subjective states that inhibits free expression and creativity reflects a specific stressor for Black children.

Meaning-Making

Meaning-making represents a developmental process first evident in infancy. For example, infants begin showing a preference for particular caregivers when the system of attachment converges. This phenomenon is foundational to infant mental health tenets that primary relationships form for early protection and promotion of well-being. Preferences for particular caregivers reflect early meaning derived from the social environments. An infant's understanding of this relationship develops over time through repeated interactions that not only represent acts of caregiving, but impart a deeper meaning of important relationships. The infant comes to know that certain adults are special, not only because they arrive at the right time with a breast or bottle, but because the relationship itself is unique. Tronick and Beeghly (2011) refer to the infants' early meaning-making processes as a "biopsychosocial state of consciousness" (2011, p. 107). Meaning-making is a critical construct embedded in Fivush's work (Fivush et al., 2008) on autobiographical memory whereby young children integrate multiple levels of experience and communication to understand who they are and what their integration into their own society should be. Black feminist scholars theorize that a socially derived *meaning* of self and other and sense of *purpose* are an ethical necessity for the ways that adults raise, socialize, educate, and prepare Black toddlers and young children for the worlds they inhabit (Lane, 2018). Black feminist wisdom suggests that coherent meaning is itself core to mental wellness (Jones & Harris, 2019). Meaning-making in families is key to empowering children to differentiate the ways

they use emotional information to understand themselves and others, and to differentiate behavioral choices to achieve adaptation (Brophy-Herb et al., 2018). By the end of the first year of life, infants are intuiting other people's motivations and intents, and this developmental capacity only continues to grow in complexity (see Ammaniti & Trentini, Chap. 14, this volume). Infants and toddlers, thus, are aware of other people's internal states as motivating behavior, and such motivations must include anti-Black or pro-Black attitudes.

Executive functioning is a central domain of social and emotional development and relates to children's growing capacity to make sense of their experiences. Executive functioning refers to three subdomains, inhibitory control, working memory, and cognitive flexibility that, together, support planning, problem-solving, and perspective taking. Early in childhood, attentional control is a precursor of later developmental processes like information processing, inherent to meaning-making. Evolving and contemporary perspectives on executive functioning suggest it is likely a contextually contingent construct, whereby cultural rules and meaning, along with a child's inherent developing sense of interconnected selfhood, combine to form autobiographically based adaptation (Doebel, 2020). Scholars like Miller-Cotto et al. (2022) discuss the significance of recentering and promoting *cultural meaning* in our understanding of Black children's executive functioning. In particular, if we first ask what executive function behaviors help a particular child to achieve belongingness in a specific context (such as at home or an early childhood classroom), we then must consider how to measure executive functioning meaningfully. Miller-Cotto et al. (2022) describe the significance of Afrocultural styles of verve, communalism, affect and expressiveness, movement, and orality as identity-based behaviors that contribute to children's sense of belongingness at home and in the community and meaningfully impact their developing identity. Yet, many early childhood environments likely require the downregulation of these styles, increasing Black children's cognitive load as they navigate these dualities via executive functioning competencies. Moreover, infants and toddlers, aware of complex ideas like motivations, observe their trusted caregivers navigating differing environments in this way, and are likely implicitly socialized.

Black Joy and Emotion Regulation

The management of arousal and valence is important to achieve belongingness in many contexts. Research on emotion regulation tends to focus on associations between the downregulation of frustration, sadness, and anger and a range of behavioral outcomes like academic achievement and mood disorders. Meanwhile, scholars point to the equal need for the development of Black joy for optimal social and emotional development (e.g., Blevins, 2023). Joy facilitates relationship development and specifically plays a role in attachment. Joy serves as a protective reserve to buffer the impacts of adversity. Joy builds other social and intellectual capacities, like glue, keeping children invested in their own development and the relationships through which intersubjectivity develops (Fredrickson & Levenson, 1998; Stifter et al., 2020). Black joy is distinct from this general conceptualization of joy and reflects the "freedom to be your whole self authentically" (Blevins, 2023, p. 4). Love, a famed author, scholar, and abolitionist educator, poignantly differentiates between "joy" and "Black joy" in her book *We Want To Do More Than Survive* (2019), writing:

> There is joy and then there is Black joy. Both are necessary for justice; however, Black joy is often misunderstood. Black joy is to embrace your full humanity, as the world tells you that you are disposable and that you do not matter. Black joy is a celebration of your identity as a person of color and signaling to the world that your darkness is what makes you strong and beautiful. Black joy is understanding and recognizing that as a dark person you come with grit and zest because you come from survivors who pushed their bodies and minds to the limits for you to one day thrive. (p. 120)

Black joy represents positive emotional arousal, borne of a culturally engaged self-other concept, which reciprocally impacts the social environment

as an act of resistance and advocacy. The development of Black joy protects the growing child, promotes coherent self-other development, and preserves and sustains Black cultural assets. Black joy represents a developmental process embedded in the earliest notions of the socially engaged infant who is meaningfully impacted by and who impacts their social relationships, establishing belongingness. Where the dominant influences in environments can lead to anti-Black bias towards emotional expression, an environment informed by Black joy supports freedom for Black children to manifest emotional development that reflects their cultural values. In such an environment, expressions of emotions are inherently valuable, with a broad and flexible range of emotions considered ideal, in supporting a complete and interactive sense of belongingness (Lozada et al., 2022). The upregulation of Black joy represents a critical strategy to this end, a lens through which children create meaning. Where belongingness is achieved through a sense of value and affirmation (Hill, 2022), Black parents invest early in the meaning-making role of Black joy when they lovingly celebrate their infant's Blackness from their name and hair to familial traditions.

Protection, Promotion, and Preservation Framework

The Protection, Promotion, and Preservation Framework (PPP; Iruka et al., 2021a) is an urgent call to action largely organized around the need for policies and practices that promote the well-being of Black infants, toddlers, young children and families. In this chapter, we have adapted the PPP framework (summarized in Table 2.1) to describe opportunities for infant mental health informed approaches to support the social and emotional development of Black infants, toddlers, and very young children. Black children's lived experiences are framed by racism and also funds of cultural wealth. In this context, social and emotional development is critically supported by protecting children's experiences in expanding intersubjectivity, promoting coherent and productive meaning-making that integrates contextually based experiences and demands, and preserving Black joy, scaffolding children's joy regulation, as fertile space for Black children's overall development.

Protection of Black Children's Intersubjectivity

Children fundamentally need environments that are physically, psychologically, and relationally safe to thrive. At multiple levels, Black children are inherently unsafe in societies all over the world where systemic racism impacts economic opportunity and privilege and begets aggression and violence to maintain control (Iruka et al., 2021a; Parker, 2021). Trauma inhibits social and emotional development by direct impacts on the child and by limiting children's psychological safety across relationships and environments. Fitzgerald et al. (2021) write, "Contemporary research supports the contention that historic trauma is intergenerationally transmitted as are the cultural stories, rituals, codes, and parenting strategies embedded within the concept of racial socialization that underly resilience within indigenous and other marginalized peoples" (p. 220). As we consider the crucial developmental state, and associated behaviors, of intersubjectivity, we illuminate the ways that Black children have opportunities to develop flexible and finely tuned capacities for adaptivity. Such adaptation requires safe contexts for intersubjectivity to develop where children may consider their own and others' subjective states without sacrificing selfhood or belongingness. At stake are core questions: from where is risk derived, and from whom do children access safety?

The Black family has a long history of providing safety to children in order to thrive amidst high-risk, racist environments. Murry et al. (2018) call this *ordinary Black family magic*, including "cultural legacies, family values, family cohesion, beliefs and goals, racial socialization, racial identity, kinship support, religion, collective socialization, optimism/positivity, and future orientation" (p. 396). Scholars have

Table 2.1 Protection, promotion, and preservation: an adapted model to support early social and emotional development in Black children

Organizational concept	Relevant concepts and processes	Examples of caregiving practices
Protection – refers to the physical, psychological, and relational health of infants and toddlers. We focus specifically on *protecting intersubjectivity* (self and self with other) as the foundation of social emotional development.	Honoring ordinary Black family magic Protective parenting processes	Preservation of families and protecting the physical safety of the child Provision of psychological safety via consistent responsive from attachment figures in culturally consistent ways and respecting the infants' autonomous functioning in culturally consistent ways Facilitation of intersubjectivity and subsequent relational safety, via the co-construction of rituals, routines, and practices in adult-child relationships, including the involvement of multiple caregivers/ extended kinship or community network; supporting the child's experiences of selfhood and self-other experiences and understandings
Promotion – references the practices and systems that enable the health and well-being of infants and toddlers. We highlight *promoting meaning-making* through family relationships that bolster healthy social emotional development.	Love Emotional socialization Parental selfhood	Engagement of critical humanizing love to foster well-being, recognize respective relational needs, promote growth and healing within systems of oppression Adult engagement in mutually rewarding, reciprocal experiences with infants and toddlers Consideration of the "whys" regarding caregivers' responses to infants' and toddlers' experiences of emotions Engagement in intentional emotion socialization practices that are responsive to children's natural drive toward interconnectedness Promotion of positive ethnic-racial identity Consideration of parental selfhood as inextricable from the sociopolitical realities of trauma, stress, past and contemporary experiences of racism
Preservation – refers to the maintenance of racial and ethnic identities, the understanding of self with other, and a connection to larger human and natural world. We emphasize *promoting Black joy*.	Four elements of Black joy: brilliance, innovation, agency, and beauty Ubuntu	Support for children's brilliant potential and preparation of environments that center and recognize strengths and assets Support for children's connectedness others and with the natural world Support for children's innovation in play and creative experiences Use of an anti-racist lens to create environments that invite and support children's agency Celebration of Black beauty and cultural identity

described the historical and persistent, contemporary presence of *fugitive spaces*, carved out by Black caregivers to ensure safety against external threats and to promote creativity and agency within these spaces internally (Mims et al., 2022). Fugitivity represents space for children away from the risks of anti-Blackness where being and belonging is truly free. Thus, these spaces may be physical spaces, such as the homes Black parents create where Blackness is celebrated. Fugitive spaces also represent relational processes in the home and beyond where storytelling, imagination, and joy are also free. As described, young Black children's growing intersubjectivity underlies the risk derived from anti-Black spaces, promoting the double consciousness that can lead to negative outcomes. Protective spaces where Black children's social and emotional development is free from conflicting and traumatic subjectivity are critical to promote a positive sense of

belongingness. In centering the needs of young Black children, intervention would free Black families, including the parent–child dyad but considering broader relational systems as well, to continue their own legacies of protection without inhibition. Programs that promote safety for children would not break up Black families when stress is evidenced; this is the practice norm, currently, in places like the United States where Black families are oversurveilled by child welfare (Dettlaff et al., 2020). Systemic change, including greater investments in economic and healthcare infrastructure for families, would best promote safety for Black children, identifying and remediating the pernicious impacts of anti-Black systemic racism on children and parents (Iruka et al., 2022).

Protective Parenting Processes Attachment plays a critical role in promoting safety for children's developing intersubjectivity. Children who have to navigate their double consciousness in anti-Black surroundings often return to their original attachment bond because it serves as their fundamental framework of belongingness and a protective fugitive space.

Protection is core to the attachment perspective across groups. Cross-cultural perspectives have clearly shown variations in both parental caregiving behaviors and children's behaviors vis a vis the attachment system (Dunbar et al., 2022; Keller, 2016). Protection has largely been operationalized in regard to perceived, and perhaps even discordant, fear of harm; for example, parents employ processes like cognitive appraisal to encourage young children be less afraid of things that may seem dangerous, like a scary spider, but are not imminently high risk (Smith et al., 2006). Black parents, meanwhile, name harm via systemic and interpersonal racism and prepare their children to face potential bias, and this perspective on protection vis a vis attachment is critical to make explicit (DiAquoi, 2017; Dunbar et al., 2022; Peters, 2002).

Social contexts such as continued systemic racism and racial and cultural norms each may elicit protective parenting processes (Anderson et al., 2015). Such positive parenting practices illustrated in Black families include high nurturance (e.g., Bocknek et al., 2020; Lewis & Weatherston, 2021), conscious buffering (Thomas, 2019), racial socialization practices (Anderson et al., 2015; Blanchard et al., 2019; Dunbar et al., 2017; Dunbar et al., 2022), and moderate emotional suppression based on contextual cues (Dunbar et al., 2022; Lozada et al., 2022). Dunbar et al. (2017) discuss *suppression* as a key aspect of Black mothers' sensitive caregiving behaviors, but suppression is often coded as negative or insensitive. Yet, when considered from the perspective of structural racism, suppression can be used as an adaptive, meaningful, and supportive strategy. Such strategies may include suppression and expectation for obedience, as well as both problem-focused and emotion-focused responses to children's expressions of emotions, each of which are designed to protect and prepare children for their interactions in the world around them (Lozada et al., 2022). Family rituals and routines, co-constructed between children, parents, and other family members are important markers of intersubjectivity, and serve as nurturing, protective parenting processes. For examples, rituals and routines (e.g., at mealtimes, bedtimes, and caregiving activities such as hair combining) promote Black children's positive identity development (e.g., Lewis, 2021) and regulation of distress in toddlerhood (e.g., Bocknek, 2018). Lewis (2019) describes the protective parental processes embedded in parenting as occurring in response to historical trauma that continues in the form of present-day bias and oppression, similar to asset-based parent and family practices integrated in the Murry et al. (2018).

Promotion of Black Infants, Toddlers, and Young Children's Meaning-Making

The principle of *promotion* uplifts the practices and systems that enable the health and well-being of infants and toddlers. As young children derive meaning from their social worlds, they rely on

important others to co-construct belongingness. Black parents are the primary source of coherent meaning-making for their children against the backdrop of racism (Spencer, 1983). A recent study (Blanchard et al., 2019) conducted with parents of toddlers presents parents' own description of intentionality in meaning-making:

> Well you know that people will say, "Well, they're not smart enough" or "not good enough." My thing with that is, you know, never let society define you, you know? So… I hope, you know, I pray the world is changed from when my father was my age. I'm praying and I am expecting the world to be a lot better place when they get my age…(referring to facing racism at work) you still see some of it and but, we live in a day now where you can do whatever you want to do and you can be whatever you want to be, you know? It's up to you. It don't matter if people like you or not. You know? It's up to you, can't nobody hold you back. (p. 393)

Some parenting research focuses on specific behaviors parents engage in, like warmth and general responsiveness, that promote positive social and emotional outcomes for children. We highlight parenting processes that are contextually informed, culturally engaged, and are relevant to the goal of belongingness. Such processes are parental love for the infant and young child, emotion socialization practices, ethnic-racial identity socialization, and parental selfhood as key constructs promoting Black children's meaning-making.

Love Our field understands parenting as dynamic and idiosyncratically developing within early dyadic rhythms. Practitioners are frequently called upon to develop strength-based perspectives of parent–child relationships, ultimately supporting loving practices that serve to support children's state regulation (Boeldt et al., 2012). Frequently, we describe loving parenting in behavioral terms, for example as nurturance or supportive caregiving. This may be reductive and prone to biases and misinterpretation as to *what* behaviors are promotive and for *whom*. Parenting is a confluence of internal states and beliefs as well as behaviors and these comprise interactive but separate dimensions. Parenting Black children also necessarily includes the sociopolitical context, and a parent's consideration of this context, in defining parenting. We use the term *love* to circumscribe parenting because, as hooks (1994) described, robust parental love and children's self-love promotes children's abilities to manage a variety of experiences encountered. By this definition, love is the construct infant mental health scholars describe when we seek to understand what matters most about parenting as an intentional act that prepares children to thrive. Love is thus an abstract concept that is made meaningful in repeated interactions between children and important family members, and it also reflects the context-specific nature of what loving parents do in order to promote thriving. Children's positive meaning-making about themselves and their relationship to their social worlds is rooted in love; love is also the lifeforce through which children impact their environments, a key aspect of the definition of belongingness. Love must be understood as necessarily politicized (e.g., Black parents' intentional and loving practices designed to prepare and protect their children from racism), mutual and reciprocal, and transformational (Guillory, 2019). The family necessarily must be the site in which love disrupts domination (e.g., Maddox (2022) referencing landmark work by both hooks (2000) and Collins (2022)). Love is not only a state but a liberatory practice for children's development to unfold. One application of this view is the work of Brown's (2020), *Parenting for Liberation*. Brown advocates parenting practices that invite children into dialogue at home and helps them to cultivate their voice, resisting the often socialized norm of obedience. Behaviorally this reflects parenting constructs like contingent responsiveness, but the contextualization of Black parents' choice to raise liberated children at home is necessarily an act of love as resistance. Black women also understand that resistance is creating homeplaces (hooks, 2007) that affirm, heal, and nurture children. These practices of love occur alongside the lived experience whereby children are also frequently socialized in emotion-inhibiting environments; thus, parental love fosters children's meaning-making as protective against the internalization of racism and conflicting values.

Emotional Socialization Emotion socialization practices typically refer to the ways in which young children construct meaning about emotions and come to understand their own and others' emotions via their interactions with others (Labella, 2018; Lozada & Brown, 2019). Emotion socialization practices include behaviors such as adults' coaching and explicit instructions about emotions, including the identification of emotions, adults' expectations about the regulation and expression of emotions, and adult modeling of emotion expression and self-regulation strategies (Eisenberg et al., 1998; Lozada et al., 2016). In infancy and toddlerhood, emotion socialization practices are often undertaken with the goal of building infants' and toddlers' understanding of emotions through emotion vocabulary and observing the context of emotions (e.g., why a certain context might elicit a particular emotion). In toddlerhood, emotion socialization practices promote emerging regulation of emotions. These socialized skills enable us to consider others' perspectives and needs and to interact with others based on our interpretations of their perspectives and needs (Halberstadt & Lozada, 2011).

Meanwhile, emotional development is inextricable from the ways "parents teach their children what it means to be Black in America" (Dunbar et al., 2017, p. 16). A stated goal within racial and ethnic socialization practices is to promote the development of cultural humility whereby children understand their own and also have increasing respect for others' backgrounds and perspectives (Green et al., 2021). In an integrated model of emotion socialization and racial socialization practices, cultural knowledge is adaptive and promotes understanding the meaning of emotions in context (Dunbar et al., 2017). Lozada et al. (2022) discuss familial practices that represent Black adaptive culture, including an emphasis on emotions in daily life and social interactions reflected in paying attention to emotional cues (an aspect of emotion understanding) and the tendency to be expressive of one's emotions.

In the language of the developmental sciences, ten emotions are viewed as primary from a structuralist point of view (Izard & Izard, 1977): interest, joy, surprise, sadness, anger, disgust, contempt, fear, shame, and guilt. Functionalist perspectives on emotions (Campos et al., 1994) suggest that each emotion serves a purpose and reflects the person–environment whole. Concurrent with this view is the idea that human behavior is driven by emotion and thus emotion should be regulated behaviorally. Social constructionist perspectives (Beauchaine & Haines, 2020) similarly adopt the view that the person–environment relationship influences emotion. From this perspective, what people experience are core affective processes, including valence and arousal as broadband attributes, and, through repeated experiences, shape internal representations of arousal and valence into named emotions through person–environment communication. Cognitive appraisal and processing of experiences plays a significant role in regulation from this viewpoint. Functionalist and social constructivist viewpoints are the prevailing theoretical architects of academic emotion theory and most practice applications. Scholars who describe *racialized emotions* (Bonilla-Silva, 2019) also describe the person–environment relationship in the expression, meaning, and regulation of emotions but in an environment in which power changes the level of agency the individual has to intentionally manipulate how emotional representations become internalized: "Individuals have agency, but in a racialized world, the odds are stacked, which explains why most people comply with existing racial norms" (Bonilla-Silva, 2019, p. 4). Emotions are considered decoupled reflexes such that a person's response to a stimulus is not automatic but mediated by a multitude of social-psychological factors. Halberstadt and Lozada (2011) discuss the ways that power that is constructed in families and societies, influencing how parents socialize their children's emotions and emotion regulation. For example, in power distant societies where obedience, rule-following, and respect for authority are emphasized, emotion socialization strategies are likely to occur as top-down conversations in which parents structure and organize their children's emotional experiences. A promotive emotion socialization practice for Black children in

particular might seek to illuminate cultural framing of emotions, improving understanding for expression and open dialogue, building a child's sense of awareness of the forces that shape emotional experiences. This represents a key value in adaptive cultural practices in Black families, leading to emotional flexibility for Black children (Lozada et al., 2022).

Ethnic-Racial Identity Socialization Both intersubjective experiences and meaning-making inform Black children's ethnic-racial identity, a construct reflecting children's understandings of their ethnic heritage, racial background, cultural assets, and pride (Rivas-Drake et al., 2014) and incorporating caregivers' cultural socialization efforts and preparation for bias (Huguley et al., 2019). Notably, ethnic-racial identity reflects children's understanding of and expectations about intra-race and inter-race interactions (Neblett et al., 2009), highlighting the important role parents and educators play in children's early meaning-making about their identities. Although studies are limited in early childhood, positive ethnic-racial identity is highlighted for its promotive and protective properties among youth (Umaña-Taylor & Rivas-Drake, 2021). Fortunately, work on ethnic-racial identity in very early childhood is underway. Eddie et al. (2023) offer the "I Can/You Can" framework, which pairs infants' and toddlers' growing social, cognitive, and language developmental milestones with caregiver practices in support of positive ethnic-racial identity. For instance, by 6 months, infants enjoy looking at themselves in a mirror, so adults may give positive descriptions of infants' physical features. Such caregiving practices are associated with children's internalization of positive identity and racial pride. In short, infancy, toddlerhood, and the early preschool years provide key periods for adults' promotion of children's positive meaning-making and subsequent ethnic-racial identity.

Parental Selfhood A parent's capacity for a love that liberates and for engagement in socialization practices that support children's growing meaning-making is necessarily influenced by parents' own developing sense of an intersubjective self. Parental selfhood is characterized by the parent's understanding of themselves as an individual and as a parent, including reflection on their ways in which their prior relational experience have impacted how they see themselves and how they perceive their children's selfhood. Such self (and other) understanding is discussed in psychoanalytic terms through theoretical frameworks such as Fraiberg et al.'s (1983) and later Lieberman et al.'s (2005) theory regarding ghosts (hurtful and harmful representations of self and other) and angels (beneficial representations of self and other) in the nursery and models of parental reflective functioning and parental trauma exposure and subsequent impacts on healthy relational engagement (e.g., Slade, 2005). Lewis (1999) names these as *intergenerational legacies* that are transmitted in repeated interactions between parent and child. Parental responses to their young children—via the parent's growing awareness and sense of wonder and curiosity about the baby and their relationship together—fundamentally inform the child's meaning-making experiences about themselves and themselves in relation to others. Njoroge and colleagues (2009) write,

> We propose that very young children are exquisitely aware of their environment, as they are drawn to social interactions and the nuances embedded in everyday exchanges. There are numerous subtle references to race and culture that are part of the fabric of life and are witnessed and examined by the studious infant. The prevailing silence around issues of race and culture may ring loudly for the curious infant, particularly as he or she becomes aware of adult intentionality…. (p. 563)

Reflective selfhood is inextricable from the sociopolitical realities of trauma, stress, past and contemporary experiences of racism, and other lived experiences. Black parents' own intersubjective experiences with racism and meaningful racial identity beliefs influence their socialization practices that promote their children's sense of meaning (Cooper et al., 2015).

Preservation of Black Joy

Within the PPP framework, preservation refers to the maintenance of the racial and ethnic identities that are central to the well-being of Black children (Iruka et al., 2021a). In a landmark report on behalf of the Center of Excellence for Infant and Early Childhood Mental Health Consultation, Blevins (2023) suggests considering Black joy in four elements: Black Brilliance, Black Innovation, Black Agency, and Black Beauty. Preservation of these areas in infant mental health research and practice creates promotive contexts for the healthy development of young Black children's intersubjectivity and meaning-making, thus supporting overall social and emotional development to unfold. Investment in and support for Black joy liberates Black children to experience their worlds with wholeness, thus protecting, promoting, and preserving social and emotional development in early childhood as a foundation for mental wellness across the lifespan.

Black Brilliance There is potential for great sophistication and brilliance for all children in this early stage of human life, leading researchers like Gopnik et al. (1999) to refer to infants as "the scientist in the crib." There is clear research evidence on the role of parental mental state language showing that cognitive state talk (e.g., think, know) has a profound impact on children's social learning (Tompkins et al., 2018).

To recognize Black brilliance in early childhood is to see both the brilliant potential of every Black child and to prepare environments for Black children that situate their cultural assets as borne of brilliance. Dillard (2020), in reflection of her experiences teaching in Ghana, describes such an environment: "And that's what you see when you enter the grounds of our school: the spirit of Black children who feel full of themselves, whose spirits have never been separated from the cultural ways of their people" (p. 699). Dillard describes the necessity of the environment itself to exist as a homeplace (Hooks, 2007) for Black children to see their brilliance affirmed and reflected back through ancestral brilliance, shaping meaning. Dillard writes that the affirmation of Black brilliance in such an environment is this: "I (re)cognize that your life stories are gifts to me, sacred and worthy of reverence" (p. 703).

Ubuntu is a philosophy that has been meaningfully situated in early learning environments and scholarship that centers Black brilliance. Ubuntu is a humanist, African philosophy emphasizing the importance of the self with others and because of others (Mugumbate & Nyanguru, 2013). Ubuntu arose from philosophical beliefs among African communities underscoring "humanness" and the value of living in a way that respects, values, and cares for the needs of others (Mugumbate & Chereni, 2019). Ubuntu emphasizes that complete personhood is situated within the collective and that the self-other relationship is not linear or hierarchical but rather embedded. Ubuntu perspectives infuse communal experiences into early childhood contexts (Koen, 2021). From the perspective of Ubuntu, children's early social and emotional development is held in the context of the child's connectedness to others and children's innate tendencies to be in harmony with others and with the natural world (e.g., responsible use of resources, caring for the rest of the animal world- also see Narvaez, 2019 for additional discussion). From this perspective, all children are brilliant as all children have capacity for unique contributions.

Black Innovation The Broaden-and-Build Theory of Positive Emotions (Fredrickson, 2001) highlights play as critical for development to unfold and for children to innovate. Executive functioning underlies young children's growing ability to innovate by supporting children in maintaining attention when faced with problems to be solved in and planning solutions to address such problems. Anthropologists describe play as the basis for human innovation because it yields flexible experimentation with what exists translating into what can be (Riede et al., 2018). Young children tend to be most flexible, compared to older children and adults, taking more risks in play. Years ago, Greenspan and Greenspan (1985) wrote about the ways in which children experiment with the overarching ideas of what it means

to be human in their play, exploring themes around love, care, friendship, and family roles. Contemporary perspectives on play (e.g., Escayg, 2021) caution against the dominant racial power structures that are often enacted in young children's play and highlight the potential of play for positive racial identity development and positive racial attitudes. This work is aligned with Broughton's (2022) naming of "frustrated play" among Black children developing within a state of double consciousness. Caregivers and educators are tasked with broadening conceptualization of play (e.g., what play looks like, how children play). Consequently, play, free to take on many forms, becomes innovative and liberating for Black children (and for all children who subsequently benefit from embracing humanity and belongingness of all). In addition, play is critical for children for a range of functions including stress management and "broadening" existing competencies as well as "building" upon existing competencies for greater mastery of skills (peer social behaviors, problem-solving, communication, etc.). Research regarding play among young Black children is scant, and the very freedom for play is liberatory. Black children's play serves as an act of protest, education, and creative problem-solving in addition to enjoyment (Mims et al., 2022). Through play, Black children make connections to the world and themselves as innovators and observe innovation among adults in their families and communities (e.g., parents who problem solve when faced with challenges and family members who create new ideas, products, art, or make other novel contributions in multi-level ways).

Black Agency Black agency refers to self-determination and children's growing awareness of themselves as active agents in their worlds. In infancy, toddlerhood, and the early childhood years, children's agency is characterized by behaviors such as the co-construction of routines and rituals, decision-making, expressions of likes and dislikes, and intentional actions in interactions with others. For example, Hilppö et al. (2016) describe ordinary events in early childhood environments, such as engaging with new materials, helping behaviors, and offering knowledge (e.g., sharing facts and stories from home), as powerful examples of agency. Agency is also an extension of or perhaps an outcome of the Black innovation in play described previously. Hilppö et al. (2016) specifically define agency as a "social construct regarding the relational connection between an individuals' capabilities, aspirations, and perceived opportunities and limitations to take action with a given task or activity" (p. 4). Work by Gilliam et al. (2016) underscore the ways in which bias limits opportunities for agency for Black children. When adults hold deficit views of Black children and their actions, opportunities for Black children to experience themselves as active agents in their words are severely limited. When adults intentionally create environments through an anti-racist lens, agency is available to children.

Belonging, Being and Becoming: the Early Years Learning Framework for Australia (EYLF; Australian Government Department of Education, Employment and Workplace Relations, 2009) is Australia's first national curriculum document for early childhood educators, families, and communities. Salamon writes in a paper intended to specifically amplify awareness for adults of infants' and toddlers' agency, "The idea that infants and toddlers are quite adept at tuning into and acting upon the nuances of a social and emotional world seems to often counter some cultural expectations of young children's capabilities (as egocentric)" (p. 5). The vast majority of research with Black parents of very young children is likely to reflect deficit framing of parents. However, in popular discourse, Black parents often describe the uplift of Black agency in their homes as fertile context for their young children's developing selfhood. In Kindred magazine (Nwoko, 2023), Professor Jasmine Cobb is quoted, "I think children should learn a history of Black hair just like they learn about Civil Rights

activism for example…I think the history can help hair become a point of pride and inspire earlier acceptance and appreciation of textured hair."

Black Beauty Black joy derived through Black beauty elevates all that is beautiful about Black culture and Black cultural representation (Blevins, 2023). Culturally engaged infant and early childhood mental health initiatives that celebrate Black beauty are pathways to support the social and emotional development of young children. Such practice supports the primary relationships within which positive cultural identity flourishes and that serve as protective spaces against anti-Blackness. An example of such an intervention is the Talk, Touch, and Listen project (Lewis, 1999). The Talk, Touch, and Listen project is a culturally grounded therapeutic intervention that supports mothers and other caregivers to engage in emotionally secure interactions and conversations with their child during the hair styling process. This hair styling process could take several hours because of the time it takes to wash and detangle tightly coiled hair. Given the role of hair for Black people, especially Black women, and its relation to standards of beauty (Mbilishaka, 2018), hair combing and styling provides an opportunity to engage young children about the beauty of their hair and in other racial socialization practices to preserve children's positive racial identity.

Summary and Key Points

Humans seek belongingness, and this is at the heart of mental health. Social and emotional processes that help a child achieve belongingness are the pathway through which children align and adapt to their environments. In this chapter, we have considered these processes specifically for Black children. We urge readers to continue their thinking about how we can authentically and meaningfully support children's social and emotional development housed within children's unique contexts. Frameworks like the Integrative Model for the Study of Stress in Black American Families (Murry et al., 2018), BlackCreate (Mims et al., 2022), and an Integrative Model of Parental Racial/Ethnic and Emotion Socialization (Dunbar et al., 2017) guide scientifically focused thinking in the contexts of Black children's development and are helpful resources in this continued work. We have also offered an adaptation of the Protect, Promote, and Preserve Framework (Iruka et al., 2021a) in which we have identified specific practices to protect Black infants', toddlers' and young children's intersubjectivity, promote children's meaning-making, and preserve Black joy. These "three P's" raise up belongingness for Black children, which is central to all development and learning. We also point readers to additional resources including new materials from the Center of Excellence for Early Childhood Mental Health Consultation promoting the centering of Black Joy (Blevins, 2023), which implore interdisciplinary professionals to contextualize Black children's development meaningfully. As noted, infant and early childhood mental health practices and programs, such as Lewis' (Lewis & Weatherston, 2021) Talk, Touch, and Listen, situate developmental support for Black families within the broader context of racism and the role of the family in promoting the positive development of Black children's identities. These examples exist alongside generations of wisdom, often disseminated through storytelling, that foster context-specific practices aimed at positive development for Black children (Denson, 2022). In short, there are rich resources from which to draw in advancing and embracing diverse frames in children's social and emotional development. Scholars are actively moving the infant and early childhood mental health field forward in important and authentic ways, and we look forward to the next generation of culturally engaged scholarship and practice. In particular, we hope this chapter will inspire future research focus on Black infants and toddlers that begins with an axiom of Black joy, seeking to understand the development of belongingness better as it promotes all social-emotional development for the youngest Black children. Through improved knowledge, we can continuously create a world in which brilliant Black babies experience belongingness with ease.

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3 Individual Differences in Temperament: A Developmental Perspective

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The goal of this chapter is to provide insight into temperament by answering the question "What is Temperament?". Beginning with a brief history of temperament, this chapter explains the early beginnings of reactivity and self-regulation then moves into the theoretical framework of temperament. After the most widely accepted framework used to conceptualize temperament has been defined, the next section examines various methodologies for measuring temperament. The following sections move into the many facets of individual and contributing factors. First, temperament is defined through the biopsychosocial lens by examining the biological underpinnings of reactivity and self-regulation and how this biological foundation is embodied in temperament attributes. Social, behavioral, and cultural contributions to temperament development are then introduced. Finally, the chapter examines temperament from infancy through adulthood, addressing developmental trajectories and clinical implications.

What Is Temperament?

Take a second and think about your current personality. Do you notice any similarities between how you are now and how you were described as a child? Maybe you were a fearless toddler who grew into the "social butterfly" in your teenage years. Defining events during your childhood may also come to mind. Certain events and experiences may take on great significance in how you view yourself today, even ones that were described by others because they occurred at a very young age. Such reflections come as no surprise, as many qualities of personality are established as early as infancy and are defined as temperament. Temperament remains relatively stable, developing at the same time. The full expression of temperament, and ultimately personality, in later life is a product of biological processes and life experiences, contributing in turn to developmental cascades. Individual differences in early temperament along with biological and contextual factors contributing to its manifestation and transformation with development are important in their own right, and their study broadens our understanding of the human experience.

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History of Temperament

The beginning of our understanding of temperament dates to ancient Greece. Galen wrote about humors and linked the four fluids with early temperament descriptions: blood as connected to being sanguine or cheerful, yellow bile linked to feeling choleric or angry, black bile to feeling melancholic or depressed, and phlegm connected to being phlegmatic or calm. Galen and Hippocrates believed these humors to have direct impacts on illness, life course, and character (Stelmack & Stalikas, 1991; Kagan, 1998). Together, the four humors were thought to create the human experience. Balancing all four humors was believed to produce optimal function and if this delicate balance was disturbed physical and psychological illness would occur. The concept of the four humors continued to be the main framework for temperament conceptualization and laid the foundation for German philosopher Emanual Kant's identification of four temperaments (Kant, 1978). Rather than a categorical approach, Kant described two dimensions through which temperament manifested: feelings and activities.

Attempting to solidify the main dimensions of temperament and personality, Hans Eysenck decided to ask adults about their traits, or the manner in which these were expressed. Several factors or broad dimensions emerged from these self-reports, including introversion-extraversion, emotional stability-instability (later named "neuroticism", Eysenck, 1947) and volition or will. Gray revised Eysenck's model by proposing three separate emotional systems: behavioral activation, behavioral inhibition, and the fight-flight system, noting individual differences in sensitivity/reactivity across systems. Gray (1970, 1973) expanded on Eysenck's claim that temperament factors are biological in nature by linking potential underlying neurological systems to behavioral expressions.

Recognizing neurological systems as underlying temperament maturation across the life span, the natural next step would be to examine childhood. Thomas et al.' (1963) work in the New York Longitudinal Study (NYLS) formed the basis for much of how temperament in children is conceptualized in recent research. Nine dimensions of temperament were identified: approach/withdrawal, threshold, mood, intensity, rhythmicity, adaptability, distractibility, and attention span/persistence. These nine dimensions were then categorized into three general styles of temperament: "difficult temperament", "easy temperament", and "slow-to-warm-up". Low rhythmicity, high withdrawal, slow adaptation, high frequency of negative mood, and intense reactions defined "difficult temperament" and regular eating, sleeping, elimination cycles, a positive approach response to new situations, along with frustration tolerance defined the "easy temperament". The "slow-to-warm-up" category included children who showed negative responses when exposed to new situations, but with repeated exposure became slowly accepting. If nine dimensions of temperament and three general styles have been identified in childhood, how do these temperament constellations impact the parent–child relationship? Thomas and Chess (1977) introduced the concept of goodness of fit, defined as the degree of match between parental demands and expectations and a child's temperament profile. Parent–child dyads with a good fit were expected to yield more positive child adjustment, whereas those with a poor fit could be expected to result in more problematic outcomes. Although subsequent research has led to significant revision in the NYLS list of temperament dimensions, these findings represent a foundation upon which subsequent investigations into early appearing individual differences were based.

Theories of Temperament and Conceptual Definitions

Buss and Plomin (1975, 1984) identified five properties of temperamental traits: (a) existence of the trait in animals, (b) adaptive function, (c) heritability, (d) early appearance and stability, and (e) little change evidenced over time. Out of these five, two have been emphasized as defining criteria of temperamental traits: early appearance and heritability or the genetic influence on the

variation of individual differences. This theoretical approach excludes traits that change considerably throughout development and fail to persist into adulthood. Buss and Plomin argued that there are only three defining dimensions of temperament: emotionality, activity, and sociability. Although heritability plays a key role in their conceptualization of temperament, Buss and Plomin acknowledge the potential effects of environmental forces that may act upon the individual to promote change.

Goldsmith and Campos (1982) proposed that there is more to the core of temperament than defined by Buss and Plomin. Goldsmith and Campos described individual differences in temperament as the likelihood of experiencing and expressing primary emotions, and in the frequency and intensity of emotional arousal. These primary emotions included anger, fear, sadness, joy, disgust, interest, and surprise. The ability for children to express emotions and to recognize, decode, and understand the emotional expression of others, or the expressive and receptive aspects of individual differences, was emphasized by Goldsmith and Campos.

The psychobiological theory of temperament is most commonly cited in current temperament research. They conceptualized temperament as constitutionally based individual differences in emotional, motor, and attentional reactivity, and self-regulation, demonstrating consistency across situations and relative stability over time (Rothbart & Derryberry, 1981; Rothbart et al., 2000; Rothbart, 2007). Rothbart's psychobiological model of temperament emphasizes the connection between temperament and biology in terms of underlying neurobehavioral systems and genetic contributions (including genetic and epigenetic effects). Consistent with this emphasis, Zwir et al. (2020) found 51 sets of single nucleotide polymorphisms (SNPs) identifying 736 genes explained 48% of the variability in temperament in a sample of 2149 healthy Finnish children.

Early appearing individual differences in emotional, motor, and attentional reactivity, and regulation are believed to reflect infant temperament (Rothbart, 2007). *Reactivity* refers to the latency, rise time, and duration of response to stimulation (Rothbart & Bates, 2006). *Self-regulation* refers to the processes involved with modulating reactivity. These processes include behavioral approach, withdrawal, inhibition, and executive attention. Regulation is not only associated with behavior but also physiologically with the regulation of salivary cortisol, respiratory sinus arrhythmia (RSA), heart rate variability, and the time between the beat of the heart and ejections of the blood into the aorta (pre-ejection period; PEP) (Beauchaine et al., 2001; Buss et al., 2004; Gunnar et al., 2003; Kagan, 1998; Matthews et al., 2002; McGrath & O'Brien, 2001; Quas et al., 2006; Quigley & Stifter, 2006). Temperament as defined by the psychobiological model has been widely applied to temperament research in part because of capturing temperamental traits across the lifespan. Rothbart in subsequent work formulated an organizational structure to temperament, with foundational consistency as well as shifts in expression dictated by developmental transitions, including maturation of the Central Nervous System (CNS).

These three theories along with the framework proposed by Thomas and Chess (1977) continue to guide temperament research. While these theories differ in specifics, there is a consensus among researchers that temperament is fundamentally a biologically based set of traits with meaningful individually differences that create the basis for how individuals experience events, and modulate emotions. Temperament traits include a variety of dimensions (fear, sadness, arousal level, activity level, etc.) rather than a single/unified concept. These temperament constructs are understood to be biologically based and relatively stable across time and situations. Studying temperament in infancy provides an opportunity to examine the earliest manifestations of temperament traits. These earliest manifestations are important in part because they can be leveraged to identify risk and protective effects, following children over time to determine how infant temperament predicts later outcomes: adjustment/mental health, social competence, educational attainment, and others, and/or intervene in non-optimal circumstances.

Measurement of Temperament

As temperament definitions refer to individual characteristics that have a biological basis, these are quantifiable at a behavioral and physiological level. Self- and other report measures of temperament focus on expressed behavior, whereas biomarkers, such as cardiac, brain activity, and cortisol level indices reflect the physiological basis of temperament. Observational methods and physiological markers have often been the methods of choice in research settings. Caregiver or self-report use has been more prevalent in applied settings, presumably because of ease of administration/interpretation and lower costs. In this brief overview we focus on self- and other report and observational methods, then discuss physiological measurement approaches to temperament.

Self- and Other Report

Temperament, observable as early as infancy, becomes more elaborate over the course of development, with affective, attentional, and motoric responses persisting over time and demonstrating a cross-situational pattern. Despite relative stability, notable developmental transitions in temperament require that questionnaire tools target specific developmental periods (i.e., infancy, toddler/preschool, school age, adolescence, or adulthood). Temperament questionnaires also vary with respect to the underlying temperament theory (i.e., Buss & Plomin framework, Thomas & Chess, or Rothbart's psychobiological model). For example, the DOTSR, the revised version of the Dimensions of Temperament Survey (Windle & Lerner, 1986) measures the nine temperament dimensions identified by Thomas and Chess (1977) across three different age groups, preschool and elementary school ages, adolescence, and young adulthood. The authors confirmed a nine-factor model for the youngest age group but identified a ten-factor structure for older participants, reflecting developmental changes in temperament.Overall, parent-report surveys represent the most frequently used assessment method for children (Rothbart & Bates, 2006). The Infant Behavior Questionnaire (IBQ; Rothbart, 1981) and its revised version (IBQ-R; Gartstein & Rothbart, 2003), for example, are based on the psychobiological approach described by Rothbart and Derryberry (1981). Both measures were shown to be reliable in terms of internal consistency, and when measuring convergent validity with respect to laboratory-based indicators of temperament (Gartstein & Marmion, 2008; Kochanska et al., 1998). Other care provider reports, such as teacher's reports, become a valuable addition to the temperament assessment tools in the preschool age, with teacher versions of surveys typically adapted from parent-report measures. The Temperament Assessment Battery for Children (TABC; Martin, 1988), a measure based on the NYLS conceptualization of temperament, was for example developed in three versions, for parents, teachers, and clinicians. Toddler temperament measures and measures for childhood and adulthood for that matter are largely a continuation of infant versions of temperament questionnaires, with developmentally appropriate changes. For example, the Effortful Control factor on the Children's Behavior Questionnaire (CBQ) differs considerably from the IBQ and the Early Childhood Behavior Questionnaire (ECBQ), as a function of maturation of the executive attention network and the growing volitional control of preschoolers over their behaviors and emotions (Gartstein et al., 2012a).

Starting with adolescents as young as 11 years of age, self-report questionnaires become the leading approach to gather temperament and personality information in adolescence and adulthood. These measures are either further extensions of early childhood scales with developmentally appropriate additions such as the emerging Affiliativeness factor in the Early Adolescent Temperament Questionnaire (EATQ-R; Ellis & Rothbart, 2001), also based on the psychobiological model by Rothbart and Derryberry (1981), or downward extensions of adult temperament measures such as the Junior Temperament and Character Inventory (JTCI; Luby et al., 1999). Adult measures of

temperament, such as the Adult Temperament Questionnaire (ARQ; Evans & Rothbart, 2007), an extension of the EATQ-R, have demonstrated associations with the Big Five Personality Scales. A five-factor structure of personality in adults has gained considerable consensus among researchers (Costa & McCrae, 1992; Digman, 1990; Goldberg, 1993), with the most frequent factor labels Neuroticism (N), Extraversion (E), Conscientiousness (C), Agreeableness (A), and Openness to Experience (O). The widespread application of the Big Five Personality Scales in a variety of research contexts has served to establish a connection between the literature on childhood temperament and adult personality. More specifically, research has established links between Negative Affectivity and Neuroticism, Surgency/Positive Affectivity and Extraversion, Effortful Control and Conscientiousness, and Orienting Sensitivity and Openness.

Observational Methods

Some of the most established structured observation procedures are the Neonatal Behavioral Assessment Scale (NBAS; Brazelton, 1973) for the early infant period, and the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith & Rothbart, 1996) for older infants and children. Observational methods are typically employed with newborns, often focusing on the evaluation of attention-based regulatory capacities (Rothbart et al., 2011). Laboratory tasks designed for earlier infancy tend to focus on reactivity to stimuli, measuring distress proneness or irritability, soothability, activity level, and alertness (Gartstein et al., 2016), later incorporating ability to orient, interest/persistence, fear/avoidance, and joy/pleasure, emerging and becoming more prominent in the second half of the first year of life. Starting in toddlerhood, effortful control becomes an additional focus in several laboratory tasks. The ability to suppress a dominant response in favor of a sub-dominant yet a more adaptive one is often studied by using delay of gratification tasks (e.g., "snack delay", Kochanska et al., 2000). Other laboratory observation tasks target behavioral inhibition (related to fear), such as via exposure to unfamiliar objects or people, or opportunities to engage in "risky" activities (Reznick et al., 1986). Behavioral inhibition in childhood and adolescence is typically measured through more subtle signs, such as the number of spontaneous comments in interviews about fears (Kagan et al., 1988) and feeling uncomfortable (Schwartz et al., 1999).

Physiological Measures

Measures that focus on a physiological basis of temperament highlight the influence of biological processes in the development and expression of temperament, and the persistence of temperament traits across development. Temperament researchers increasingly include physiological measures to complement observation-based behavioral measures to demonstrate that behavioral expressions of temperament are the manifestations of underlying biological processes. The earliest indicators researched to establish this connection were heart rate and heart rate variability. Kagan and colleagues (Garcia Coll et al., 1984; Kagan et al., 1987) found a relation between heart rate and social behavior, linking high and stable heart rate in children with "inhibited" or more fearful and anxious behaviors. The autonomic nervous system became another focus of interest, particularly the complex interplay of the sympathetic (SNS) and parasympathetic (PNS) nervous system. Heightened activity of the SNS in periods of stress and emotional arousal (measured by heart rate and pre-ejection period (PEP)) is modulated by PNS activity (measured by heart rate variability (HRV) or vagal tone (Vna)). High baseline Vna, for example, has related to better regulation and soothability in infants (Calkins & Fox, 2002) and higher approach tendencies to strangers, regulation in frustrating situations, and lower levels of aggressions in toddlers (Calkins & Dedmon, 2000). Furthermore, high baseline Vna has been linked with self-reports of greater emotion regulation and more effective coping strategies in college

students (Fabes & Eisenberg, 1997), establishing a developmental trajectory that links high baseline Vna to behavioral temperament outcomes. Interestingly, vagal regulation in the form of decreases in Vna, referred to as "the vagal break" in Porges' polyvagal theory (Porges, 2011), associated with an increase in heart rate and greater attentional control and self-soothing behavior in infants and school-age children (Calkins et al., 2007). In regard to SNS, children higher in "surgency", exhibiting greater approach tendencies to novelty, sensation seeking and impulsivity (Ahadi et al., 1993), showed better emotion regulation skills when PEP baseline and reactivity scores were higher (Stifter et al., 2011).

Neurobiological Measures

Measures of neural activity using electroencephalogram (EEG) techniques provide information regarding cortical activity at rest and in response to a stimulus, as well as functional connectivity. Of particular interest in temperament research are differences in frontal left and right hemispheric activity measured via EEG. Greater left frontal activation has been linked with more relaxed mood and less anxiety in response to stress-inducing situations, as well as a greater likelihood to interpret neutral stimuli as positive (Fox & Davidson, 1987, 1988). On the contrary, greater activity in the right frontal area has been connected to expressions of negative affect and withdrawal from novel or stressful situations. In a review of related studies, Coan and Allen (2004) concluded that asymmetry in frontal EEG activity is related to trait predispositions, specifically response tendencies and changes in emotional state in emotionally charged situations.

Differences in temperament are also studied with functional (fMRI) and structural magnetic resonance imaging (sMRI), focusing on differences in neural activation and brain structure. Amygdala functioning has, for example, been related to reactive temperament, reactivity to novelty in particular, and the dopamine transmitter system has been related to extraversion and surgency (Rothbart, 2007). Temperament differences have also been linked to variations in the excitability of the amygdala and its projections to the SNS chain. In a seminal study, Schwartz et al. (2003) demonstrated differences in amygdala activity among adults who had been categorized as uninhibited versus inhibited in infancy, providing evidence that emotion-/motivation-related brain activity shows consistency across development. In a follow-up fMRI study (Schwartz et al., 2012) differences in thickness in the orbitofrontal cortex were also identified, wherein lateral differences in cortical thickness were linked with temperament variability, consistent with the EEG-based findings. Specifically, greater left frontal cortical thickness was observed in adults categorized as low in reactivity in childhood, whereas adults previously categorized as highly reactive showed greater cortical thickness in the right frontal hemisphere.

Hormonal Indicators

Cortisol level markers represent another set of psychobiological measures utilized in temperament studies. Cortisol can be described as the primary hormone resulting from the hypothalamic-pituitary-adrenocortical (HPA) axis activity, often referred to as the "stress hormone". Cortisol levels are typically measured in saliva to study activation of HPA in response to environmental stimuli and related behavioral responses. Cortisol concentrations vary throughout the day following a rhythmic pattern, and are also reactive to external stressors. Positive associations between shyness and higher levels of cortisol were found in several studies (e.g., Rosen & Schulkin, 1998; Watamura et al., 2003), while moderate levels were associated with approach behavior and greater cognitive and behavioral inhibitory control (Blair et al., 2004). However, contextual factors, such as peer group influences or the nature of the sampling environment have been found to impact cortisol levels, thus need to be considered when examining neuroendocrine functioning and behavior. Salivary alpha-amylase (sAA) has been used more recently to measure SNS activity related to temperament, as the

protein increases in response to sympathetic stimulation. For example, higher levels of sAA were correlated with lower levels of anger and impulsivity (Eisenberg et al., 2009), and predicted increased ability to delay gratification in preschoolers (Lisonbee et al., 2010).

Measurement Error

All measurement methods are prone to potential sources of error, factors that impact the reliability and validity of a measure. Confidence in a measurement tool increases with greater reliability (i.e., consistency with which a measure replicates temperament attributes across time, raters, or items) and validity (i.e., accuracy with which it reflects the attributes it was designed to measure). Each measurement approach has unique challenges that may impact its validity and reliability. In regard to self- and other report measures, caregiver ratings have been described as vulnerable to social desirability (Kagan, 1998), leading, for example, to inflations of a child's rating reflecting positive emotionality. Parental perceptions of their child's temperament are also influenced by their own experience, as mothers with depressive symptoms, for example, tend to report higher levels of "difficult temperament" (largely driven by distress proneness) and fearfulness for their children relative to other sources of information (e.g., other caregivers, behavioral observations; Leerkes & Crockenberg, 2003; Whiffen, 1990). In addition, caregivers' memory of their child's behavior or emotional response might not be accurate, their experiences as to what is developmentally normative or how to interpret the child's behavior could be atypical, and there could be difficulties with item or instructions understanding (Saudino, 2003). Some of these sources of error can be addressed by multi informant approaches and asking about recently occurring events and concrete child behaviors instead of more global, comparative judgments. A strength of caregiver report, on the other hand, is the fact that parents are most familiar with the child and can thus provide detailed descriptions based on their unrestricted access.

Observational methods face have their own challenges, as laboratory environments may have an impact on behavior. A novel environment with unfamiliar experimenters could elicit more fearful reactions from a child, and may also lead to underestimates of positive affectivity (Kagan, 1997), not capturing the full repertoire of a child's reactivity and regulation skills. However, observations do not rely on the report of a parent or caregiver. Instead, tasks are typically video recorded and undergo a coding process by multiple trained coders who independently rate temperament-related behaviors, and then seek to establish interrater agreement according to predetermined rules. Concerns with physiological measures most frequently involve their intrusive nature (e.g., sample collection, electrode placement) and the potential influence of external factors such as stress/anxiety or time of day on findings. In addition, mechanisms underlying physiological responses are often difficult to interpret, with additional sources of information (e.g., behavioral responses) typically required to make connections with temperament.

The combination of different measurement approaches such as physiological measures, self- or other-report, and observation will likely have the greatest utility to gain a more comprehensive picture of temperament, how it develops and predicts later outcomes. Longitudinal studies, following the same individuals over time, are critical in providing information regarding developmental trajectories of temperament and links to later personality as well as adjustment/mental health parameters.

Developmental Trajectories of Temperament

Temperament represents a perfect illustration of the developmental paradox – there is notable stability alongside growth and change. While some temperament researchers like Buss and Plomin focused on stability, others emphasize developmental changes in temperament-related processes (e.g., neurobehavioral maturation) and their impact on different manifestations of

temperament. These shifts in behavior and motivation are most clearly seen during the rapid development unfolding in the first year of life. Reaction to novel or unfamiliar stimuli provides one relevant example of changes in emotion/motivation across the lifespan. Fearful reactivity is not prominent in the early months of infancy when babies have little ability to distinguish between familiar and unfamiliar objects and people, and when there is limited independent locomotion. Towards the end of their first year of life, when infants are able to crawl and grasp objects and their memory also improves, hesitancy to approach novel objects can be observed (Rothbart, 1988). When fear is measured across the first year of life there are notable increases from 10 to 12 months of age when considering parent report and laboratory observations (Gartstein et al., 2010, 2018). Fear cues are easily identifiable in toddlers, as they typically begin to cry, pull away, and seek safety (e.g., proximity to parent) in the presence of, for example, unfamiliar adults. In adolescence fear to novelty is most notable in reactions to social situations and is associated with anxiety about social rejection/evaluation (Schwartz et al., 1999). Thus, action of the motivational/emotional systems varies across development, with timing of emergence and prominence often coinciding with other developmental milestones (e.g., walking that increased opportunity to come in contact with dangerous objects or situations).

Infancy

Distress signals are evident at birth, although differentiated distress signaling specific emotional reactions does not become evident until about 2 months. By 2 months, frustration and anger are demonstrated when the infant is restrained. At this age anger and frustration are exhibited behaviorally when a desired action/goal is blocked (i.e., arm restraint), and are thought to be related to the approach emotional/motivational system responsible for a reward-focused orientation (He et al., 2013). At about 4–6 months, fear and irritability become increasingly differentiated, suggesting the beginnings or behavioral inhibition (fear) associated with novel stimuli. Motor activity typically linked with distress earlier in infancy, tends to occur more frequently in the context of positive affect during this later developmental stage. For example, Calkins and Fox (2002) found a relationship between high motor activity and positive affect at 4 months, both associated with bold behavior in later childhood. Infants higher in positive affect have the tendency to be engaged with, rather than disengaged from, their environment, consistent with relative dominance of the approach motivational/emotional system. For example, those characterized by high levels of approach demonstrate rapid grasping of objects, related to smiling and laughter. As noted earlier, fear/behavioral inhibition develop rapidly in the second half of the first year of life, as do infants' regulatory abilities closely linked with advances in attentional skills.

The regulation-oriented dimension of temperament emerges in early infancy and undergoes rapid development throughout childhood. In infancy, regulation is related to attributes such as duration of orienting and soothability (responsiveness to being comforted by caregivers), and also ability to enjoy calm pleasant activities (e.g., looking at pictures). The latter is not surprising given that immaturity of infant control of attention often necessitates external (i.e., caregiver) involvement in regulatory functions. Self-regulatory skills becoming more proficient with age, as the child begins to engage in effortful control, relying less and less on adult interventions aimed at regulating behavioral and emotional reactions (Posner et al., 2012).

Childhood

In early childhood, individual differences in reactivity and regulation emerging in infancy become consolidated, and their behavioral manifestations change with a more advanced response capability, as well as exposure to more complex situations. Greater approach/higher levels of positive affectivity (often referred to as surgency) begin to manifest as impulsivity and preference for intense

experiences during toddlerhood. At the same time effortful control, closely linked with one's ability to inhibit a prepotent response in favor of a more adaptive novel response, advances, supporting improved self-regulation (Kochanska et al., 2000). The relationship between language acquisition and temperament begins to emerge during this developmental stage. Language abilities become important corollaries of regulatory capacity as increases in verbal self-regulation (i.e., self-directed speech) are observed (Vaughn et al., 1984; Reed et al., 1984). Language development has also been linked with individual differences in attention and delayed gratification (Kopp, 1982; Putnam et al., 2002), supporting self-regulation beginning in the preschool period. These connections are maintained into middle childhood and early adolescence, as for instance correlations between verbal IQ and temperamental were reported by Matheny Jr. (1989). Starting in middle childhood, greater stability in temperament had been noted, with some continuity into adulthood for traits such as surgency/positive emotionality and anger/hostility (Kubzansky et al., 2004; Shiner et al., 2002). It should be noted that there are considerably fewer studies addressing temperament in middle childhood, perhaps because of the lack of marked developmental shifts.

Adolescence

Like infancy, adolescence is another period marked by rapid development, and biological, psychological, and social systems undergo considerable change (Feldman & Elliott, 1990; Spear, 2000). Puberty is associated with physiological and neurobehavioral changes and is also a time of marked changes in social milieu. The transition to adolescence involves the establishment of some level of autonomy, increased engagement in peer relationships (including romantic ones), and further changes in attention-based regulatory skills. Despite widely noted adolescent vulnerability to engage in risky behaviors, information processing becomes more efficient as a function of brain maturation. Executive functions become more advanced, with greater cognitive flexibility (Steinbeis & Crone, 2016), albeit not always effective emotion regulation. During adolescence, improved attentional skills and working memory facilitate self-monitoring and learning from feedback (Crone & Dahl, 2012). Research indicates a decreasing trend in child negative affect and overall emotional intensity from early childhood to adolescence thought to result from improved emotion regulation skills supported by executive function advances (Murphy et al., 1999). At the same time, the growing demands of adolescence (e.g., increased conflict with parents, complexity of early romantic relationships) likely exceed even these more advanced regulatory skills, leading to vulnerability (Yap et al., 2007). With respect to temperament structure, additional elements have been noted for adolescent samples. Specifically, a dimension of labeled affiliativeness, defined as the desire for warmth and closeness to others (Ellis & Rothbart, 2001; Latham et al., 2020), emerges in adolescence and captures unique aspects of temperament gaining prominence during this developmental stage. The emergence of this new attribute, recently replicated with a large representative sample of adolescents (Latham et al., 2020), reflects the importance of social interactions during this time, now typically involving peers and not just family members.

Overall, differences in the expression of temperament across the lifespan are thought to be closely linked with other developmental changes. In infancy, temperament development is primarily a function of changing reactivity, with various domains of emotionality "coming online". Temperament is expressed largely in responses to stimuli with babies relying on caregivers for regulation of internal experiences. Later dominant developmental shifts involve advances in self-regulation. Cognitive skills (e.g., attention, language) come into play with respect to self-regulation as children can interact with more complex environments in a more autonomous manner. As noted, peers begin to impact daily routines and experiences during adolescence, increasing the complexity of social interactions. Children elicit different reactions as a function of

their temperaments and seek out different environments as a function of their temperament (e.g., more fearful/behaviorally inhibited youngsters are likely to avoid engaging in boisterous peer interactions). As demands and complexity increase, a corresponding developmental transition toward more effective regulation of emotions and behaviors, as well as volitional control of attention, is required. Although the stability of temperament tends to increase with age, some changes occur even in adulthood when the focus of individual differences research shifts from temperament to personality (Caspi & Shiner, 2006).

Cultural Contributions to Temperament Development

Culture encompasses a set of attitudes, values, goals, and practices of a group that provide a shared approach to family life. Parents are motivated to raise their children according to values of their cultural group, and align child characteristics such as temperament with cultural expectations (Kohnstamm et al., 1989). Thus, culture is a powerful influence on temperament development, shaping how emotions are experienced, evaluated, and regulated. Culture also plays a role in responses to temperament, that is in how parents and adults more broadly, as well as peers and institutions, respond to children who manifest different temperament profiles. In fact, effect sizes associated with culture are often greater than other significant factors for social-emotional development such as age and gender (Achenbach & Rescorla, 2007), indicating that shared experiences of a cultural group have a profound influence on individual development (Bornstein, 2013).

Common Approaches to Cross-Cultural Studies

Cross-cultural differences in temperament and personality have been identified, starting with infancy and into adulthood. Mean-level temperament comparisons have been a widely used approach to cross-cultural studies, often describing temperament expressions of 2 or 4/5 countries with large cultural differences such as East–West comparisons. For example, Chinese toddlers were found to have higher levels of behavioral inhibition compared to Canadian toddlers (Chen et al., 1998). Similarly, Chinese and South Korean toddlers were found to be more inhibited compared to Australian and Italian toddlers in a study by Rubin et al. (2006) comparing five countries (including Canada). Individualism/Collectivism distinctions have played another major role in addition to East–West comparisons when explaining temperament differences. In a study of toddler temperament in four countries (Chile, Poland, South Korea, and the United States), Krassner et al. (2017) found support for an Individualism/Collectivism distinction regarding negative affectivity (NEG, one of the ECBQ factors), with Chilean toddlers being rated the highest, followed by Korean, Polish, and US toddlers. For surgency, however, an East–West distinction emerged with US toddlers being rated the highest, followed by Polish and Korean toddlers.

Recent Developments in Cross-Cultural Temperament Research

More recently, temperament studies have made an effort to compare a larger number of countries to elucidate possible reasons for temperament differences. A meta-analysis of temperament data from 18 countries (Putnam & Gartstein, 2017) indicated a consistent pattern in mean level elevations of the three overarching factors of the ECBQ, with higher levels of NEG and lower levels of Surgency (SUR) and Effortful control (EFF) in East Asian cultures compared to Northern European cultures. Results from the Joint Effort Toddler Temperament Consortium (JETTC, Gartstein & Putnam, 2018), which compared toddler temperament data from 14 different countries around the world, confirmed documented differences between Eastern and Western

cultures, with higher levels of NEG in toddlers from Asian countries (China, Korea, Turkey), low levels of NEG in US and Western European toddlers (Belgium, Finland, Netherlands, and Italy), and mid-levels of NEG for Eastern European countries (Russia and Romania). Similarly, Finnish and Belgium toddlers scored highest on SUR, significantly different from Korean, Turkish, and Chinese toddlers, with Russian and Romanian toddlers scoring in between (Slobodskaya et al., 2018).

While most cross-cultural studies have focused on a single developmental period or have been cross-sectional in nature, some noteworthy exceptions indicated consistency across the lifespan, such as Gaias et al.'s (2012) comparison of infants, children, and adults from Finland and the United States. Across all timepoints, US participants showed higher temperamental fearfulness compared to their Finnish counterparts. Cozzi et al. (2013) studied infants and toddlers from Italy and the United States and found that across both developmental periods, Italian children were more cuddly and lower in high-intensity pleasure compared to US children. High-intensity pleasure is a subscale of surgency (SUR) and cuddliness a subscale of regulatory capacity (RC).

Translating Cultural Values Into Everyday Life

How is culture transmitted on a daily basis? The concept of the "developmental niche," developed by Super and Harkness in 1989, offers an explanatory model, identifying customs (e.g., child rearing customs), settings (e.g., child care), and caregiver psychosocial characteristics as essential agents. Among most influential caregiver characteristics are parental ethnotheories (Harkness & Super, 1996) or beliefs how a child should be treated, along with socialization goals (qualities that a child should develop early in life as the driving force, Keller et al., 2006). Parental ethnotheories and socialization goals have been conceptualized in terms of relational and autonomy-focused domains, paralleling the individualism/collectivism dimension noted earlier. The concept of the "developmental niche" and parental ethnotheories/socialization goals, in particular, have provided the means for making connections between macro/culture level effects and the micro/home environment and daily routine, translating into cross-cultural differences in child temperament. Continued advances in cross-cultural temperament studies, such as the use of large-scale data sets from multiple countries, advanced statistical methods (e.g., multilevel analysis), and combining several developmental stages in explaining similarities and differences between temperament expressions in different countries makes this an exciting area of research to follow.

Gender Differences in Temperament

Gender differences have been widely reported for adult personality traits (Del Giudice et al., 2012; Feingold, 1994; Weisberg et al., 2011), but understanding the origin of these differences requires infant and toddler studies. Markedly fewer differences between males and females are found in children younger than 1 year of age with differences becoming more evident in toddlerhood (Bates, 1987; Else-Quest et al., 2006; Rothbart, 1988). In the first year of life, boys presented with higher activity levels than girls, with this difference expanding after infancy (Eaton & Enns, 1986). Along with greater activity, boys in the first year of life have been reported to demonstrate more approach-related behaviors (Campbell & Eaton, 1999; Gartstein & Rothbart, 2003; Gagne et al., 2013; Maziade et al., 1984), whereas girls were shown to exhibit greater hesitation to approach novel objects, as assessed via laboratory observations and parent report (Carey & McDevitt, 1978; Cosentino-Rocha et al., 2014; Gartstein & Rothbart, 2003; Hsu et al., 1981; Maziade et al., 1984; Martin et al., 1997; Rothbart, 1988). A meta-analysis documented large effects indicating greater effortful control in girls (Else-Quest et al., 2006), which may be protective with respect to conduct problems. Although some method-related variation in the patterns of gender differences in temperament can be identified, consistency is also notable, for

example with respect to greater fearfulness exhibited by girls (Olino et al., 2013). Although contextual factors (e.g., gender role expectations influencing socialization/parent–child interactions) are typically emphasized, biological effects could also play a role in shaping gender differences in temperament (e.g., in utero exposure to high levels of androgens; Martel et al., 2009).

From Temperament to Personality

Temperament and personality both embody constellations of individual differences and research supports strong links among them, with some arguing that temperament and personality are the same construct (e.g., Caspi & Shiner, 2006). However, others suggest that temperament identified as early as infancy transforms into personality with maturation and experiences (McCrae et al., 2000; Kagan, 1997). Alternative views cast temperament and personality as distinct constructs. For example, according to Cloninger personality represents a combination of temperament and character, wherein temperament encompasses emotional and behavioral predispositions and character represents a component of a self-concept (Cloninger et al., 1993). According to Rothbart and Ahadi (1994), temperament is a component of personality, with personality representing a combination of temperament, cognitions, values, and goals as well as perceptions of the self, others, and events. According to Rothbart et al. (2000), temperament provides the biologically based foundation upon which personality develops. Importantly, a sizeable literature provides evidence of empirical links between temperament and personality. Infant temperament contributes to individual differences in personality later in childhood, as surgency becomes extraversion, taking on a new aspect of leadership in peer groups (Shiner & DeYoung, 2013). Greater awareness of the self and forward thinking (e.g., anticipatory anxiety; Caspi & Shiner, 2006) transforms negative emotionality into neuroticism as children mature and cognitive skills advance. It has also been shown that more regulated infants exhibit higher levels of conscientiousness as children (Slobodskaya & Kozlova, 2016). Thus, biologically based temperament traits shaped by socialization and other contextual influences are thought to transform into a constellation of personality attributes that exhibit greater stability with age (Roberts & Del Vecchio, 2000).

Important differences between temperament and personality should, nonetheless, be considered. Temperament traits manifest through biological processes and are present during infancy and some would argue prenatally (Dipietro et al., 2018), while personality is thought to "come online" later in childhood. Multiple components of personality, for example, self-concept, expectations, and coping strategies, are not considered a part of temperament, making personality a broader construct, encompassing earlier temperament and other domains of functioning/adjustment shaped by lived experience.

Temperament and Symptoms/Disorders: Clinical Implications

A large body of literature has related temperamental negative emotion to both externalizing (i.e., acting-out/disruptive behaviors) and internalizing (i.e., over-control/emotional distress) symptoms (Rothbart & Bates, 2006; Thomas et al., 1970). Anger/frustration contributes to both internalizing and externalizing difficulties, whereas fear and sadness primarily predict internalizing problems (Gartstein et al., 2012b; Oldehinkel et al., 2004; Rothbart & Bates, 2006). For example, fear was linked with internalizing and frustration with externalizing problems in a sample of preadolescents, with an impressive convergence of results across parent and child reports. The link between early behavioral inhibition, as noted closely linked to fear, and later internalizing symptoms (social anxiety in particular) has been well established (e.g., Schwartz et al., 1999). In addition, externalizing problems, frequently associated with high surgency and especially impulsivity, are often elevated in uninhibited children (Schwartz et al., 1996), suggest-

ing particularly low levels of fearfulness may also be problematic.

Although high levels of surgency/approach pose risk for externalizing symptoms, internalizing problems, and depressive symptoms especially, are thought to result largely from insufficient activations of the behavioral approach system, thus low surgency/approach have been described a predisposing factor for internalizing/depressive symptoms (Fowles, 1994). In fact, a positive affectivity factor, including sociability, interest, and positive emotion (based on laboratory and home observations at 3 years of age), predicted lower depressive symptoms at age 10 after accounting for earlier negative emotionality and depression (Dougherty et al., 2010).

Effortful control also plays a role in shaping both externalizing and internalizing problem trajectories, with a stronger influence often reported for externalizing difficulties. For example, lower effortful control emerged as a significant predictor of increased externalizing difficulties in the preschool period, after accounting for child gender, parental depression and coercive behaviors, as well as marital adjustment (Gartstein & Fagot, 2003). In the Oldehinkel et al. (2004) study effortful control was the primary predictor of externalizing behavior, associated with a large effect size. Eisenberg et al. (2009) found that deficits in attentional control specifically predicted high and increasing levels of internalizing problems in school-age children.

These and other relevant findings linking earlier manifestations of temperament to later symptoms/disorders have a number of clinical implications. Importantly, risky temperament profiles can be targeted, providing preventative services aimed at decreasing the risk. Temperament assessment can also serve as a "vehicle" for an intervention, as with "INSIGHTS into Children's Temperament" – a program for parents and teachers to learn about temperament and how it contributes to the interactional dynamics. According to McClowry and Collins (2012), the goal of improving the goodness of fit: "… replacing counterproductive responses with those that foster children's social competence" (p. 612). INSIGHTS includes a comprehensive psychoeducational component encompassing temperament and related concepts, then targets child self-regulation and cooperation, also offering a strategy toolkit to parents and teachers individualized to specifically address relevant temperament type(s). There are other examples of temperament-based intervention approaches that can be leveraged by different systems of care and scaled as needed. Cameron et al. (1994), for example, made a prevention program available to members of Kaiser Permanente in CA, providing information about their child's temperament profile based on responses to a questionnaire. Boys who participated in this temperament guidance program made fewer behavior-related visits to pediatric and psychiatric services over the subsequent 15 years; however, that effect was not observed for girls (Cameron et al., 2013). Parents of infants with more challenging temperament profiles demonstrated the most profound reduction in psychiatric visits (Cameron et al., 2013).

Summary and Key Points

Temperament development occurs at a complex intersection of biology, socialization, and other contextual factors. Biology provides the foundation for temperament development, whereas environmental forces shape the manner in which temperament is expressed. Complexity is in part a function of the fact that a variety of environmental factors, from parental stress to peer relationships can play a role, with some biological effects also rooted in environmental causes. For example, maternal prenatal exposures (e.g., stress, substance use) translate into physiological changes that are transmitted to the fetus via different signaling pathways (e.g., involving cortisol concentrations) relying on epigenetic mechanisms to impact brain development and temperament in turn (Gartstein & Skinner, 2018). Understanding these connections provides insight into adaptive and maladaptive temperament developmental trajectories and opens additional avenues for preventative services/early intervention.

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Exploring Early Cognitive Development in Context

4

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In the 1960s, Jean Piaget revolutionized the field of developmental psychology by directing attention to the understanding of this core domain of development – and starting an empirical exploration of cognitive development. *Cognition* encompasses a broad range of conscious and unconscious mental processes involved in perception, learning, thinking, and remembering. Growth in cognition (i.e., cognitive development) is a complex dynamic process that is characterized by both external and internal contributions to change over time.

In this chapter, we focus specifically on infancy and early childhood and explore key aspects of cognitive development from birth to age 5. Prior to the 1960s, there was limited understanding of infants' perceptions and cognition, with greater attention focused on sensorimotor development. Beginning with the work of Piaget, researchers began to see infants as active agents capable of constructing their own realities. Now, as a result of theoretical advances and improvements in methodological tools (e.g., habituation paradigms, visual preferences, and brain imagery) we recognize infancy as a period of rich cognitive development. Neuroscientific research has confirmed that rapid growth and neurological development occur in the human brain during the first few years of life. Throughout this chapter, we will highlight age-related changes in several key cognitive competences, discuss the environmental contexts in which these changes occur, and highlight the social processes underlying the development of these skills over time. Cognitive development includes a broad range of topics and has been studied using a variety of methodological and theoretical approaches (Bjorklund, 2022). However, there are several generalizable 'truths' that are accepted across the field. First, cognitive growth displays several typical patterns. Across domains, children increase in their ability to perform more complex tasks with age. *Information processing models,* in particular, emphasize improvements to children's encoding abilities (i.e., how information is represented; Siegler, 1989). Notably, change is marked by both stability and plasticity (Bjorklund, 2022). Individual differences in cognition tend to remain stable over time; however, early experiences and trajectories are not deterministic and cognitive development is still malleable based on later experiences. Another common pattern indicates that as children grow, they gain greater levels of conscious control over their cognition and behavior.

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Second, cognitive development occurs within social contexts. *Sociocultural theorists* posit that children learn both *what* to think and *how* to think through interactions with members of their cultural group (Rogoff, 1990; Vygotsky, 1978). These social interactions contribute to the acquisition of various cognitive skills. Although many aspects of cognition are universal, development is also context-specific and occurs within the norms and expectations of a given culture. For example, children from all cultures can recount past experiences, but the type of details and narrative form differs across cultures. Thus, differences in cognitive abilities may be partially attributed to contextual factors.

Finally, cognitive development is a dynamic complex process (Bjorklund, 2022). It involves changes within the child but is also influenced by external factors. Cognitive developmentalists have used both a *bioecological model* (Bronfenbrenner & Morris, 2006) and *dynamic systems theory* (Thelen & Smith, 2006) to understand how individuals grow as part of complex systems. These theoretical frameworks present change as part of bidirectional relations between the child (both at the biological level and as the result of individual actions) and their environment (including social relationships and cultural influences). Children are, therefore, active agents in their own development, as individual characteristics (temperament, motivation, etc.) influence developmental processes (Bronfenbrenner & Morris, 2006). Notably, changes at one part of a system may influence development at another. For example, children's acquisition of language competencies may lead to an increase in parent–child conversations about past experiences, thus supporting memory development.

Processes and Mechanisms of Change

Children display marked changes in their cognitive competencies across the first 5 years of life. Despite extensive documentation of age-related changes, less is known about the developmental processes underlying this observable growth. Although cognitive researchers have called for greater attention to how change occurs, research is limited due to scientific and practical constraints. However, researchers have identified both neural and social mechanisms associated with cognitive development.

Development during infancy and early childhood reflects changes to brain structure and functions (see Taylor, 2006). Neuroimaging technology has helped provide structural information about the brain and the spatial locations of neural activity, revealing that different neural networks are involved in different cognitive tasks. Newborn infants are born with all features that are evident in adult brains and the majority of postnatal brain growth occurs within the first 2 years of life. Maturational changes (e.g., growth of brain size) follow a typical course of development. However, other forms of neural development are more heavily dependent on experiences. During early childhood, the human brain experiences extensive synaptogenesis (creation of synapses between neurons); however, only the networks that are used remain stable, while unused connections disappear (synaptic pruning). Thus, neural networks can be shaped by cognitive function. Furthermore, certain brain regions are more susceptible to environmental influences, while others are more reliant on genetic factors. As a result, cognitive development is not solely the result of neurological growth, rather it stems from the complex interplay of genetic and contextual factors.

Numerous researchers have theorized about the nature of the relationship between genes and the environment. Gottlieb (1991) posited that functioning at the genetic, neural, behavioral, or environmental level influences adjacent levels. Thus, development is initiated by the interactions between different components rather than an individual level. Moreover, gene expression can be moderated by environmental influences, known as gene–environment interactions. External sources cannot change gene sequences but may play a role in the activation and resulting expression of certain genes through epigenetic processes.

One primary environmental influence on cognition is social interactions. Theorists have proposed several processes through which children learn to perceive, think, and remember as part of a cultural group. Bandura (1989) emphasized the importance of observation in learning. Children attend to the behaviors of other people, and through this process learn how to act and think. Meanwhile, Vygotsky (1978) suggested that skills first begin on the interpersonal plane (through interactions with parents, peers, etc.). More knowledgeable members of a social group may pass on information through scaffolding. A child's *zone of proximal development* is the area between what they can accomplish independently and what they can attain through adult guidance. This can be targeted through learning interactions that, through adult support, can increase children's cognitive performance. Finally, Rogoff (1990) described the significance of participating in culturally relevant actions. Shared activities and interactions with adults or older children lead to an *apprenticeship in thinking*, where children develop certain aspects of individual human cognition. Furthermore, *guided participation* (when children and caregivers participate in relevant activities through tacit communication) supports this process. Over time caregivers adjust levels of support offered during shared tasks, gradually transferring higher levels of responsibility to children. Caregivers can also shape cognition by structuring situations that influence what is learned. In this chapter, we highlight social processes that have been linked to specific domains of cognitive development. We focus on specific areas of cognitive development during infancy and early childhood, addressing developmental considerations, change over time, relevant contextual factors, and processes that support development.

Attention Development

Attention is a multifaceted construct that underlies a number of cognitive processes (e.g., memory) and includes behavioral and neural components. Although there is less agreement regarding a comprehensive definition of attention, one shared theme is that of selection: an individual must orient and select information from a stimulus for other processes to occur. There are two dimensions of attention that develop over infancy: (1) sustained attention and (2) joint attention. Preliminary attentional abilities exist at birth, and as intrinsic processes become more sophisticated and interactions with the surrounding social world increase, infants' attention becomes more complex and differentiates into sustained and joint attention (Colombo, 2001).

Developmental Considerations and Change Over Time

Sustained Attention Attentional abilities increase over time and are influenced by both internal and external processes. Researchers assess attentional abilities via looking time paradigms that record the duration of time that children spend looking at a stimulus, performance on computer tasks, observational measures (Brandes-Aitken et al., 2019), and neural indices (e.g., electroencephalogram event-related potentials). Attention can be separated into three phases during the first 2 years of life. At birth, attention involves arousal and alertness that is often limited to short durations. Arousal and alertness are largely influenced by subcortical regions during the first 2 months (Johnson & de Haan, 2015) and infants' attentional abilities begin to mature from reflexive responses to stimuli (Ruff & Rothbart, 2001) to the ability to engage in joint attention with others (e.g., following others' direction of attention) across the first 6 months of life. In addition, over the first few months of life, infants develop better attentional abilities and demonstrate the ability to look longer at more complex stimuli, like faces and social interactions (Ruff & Rothbart, 2001). Furthermore, during the first 6–12 months, infants can orient toward sensory input and select information to encode. It is also during this time that the brain regions involved in attentional abilities (e.g., anterior cingulate cortex, prefrontal

cortex, and parietal areas) begin to mature and play a vital role in coordination, regulation, and information processing, all of which are important characteristics of attentional abilities. Finally, around 12 months of age, the neural connectivity between networks that direct attentional processes becomes stronger and allows infants to engage in more sophisticated, conscious attentional control. It is during this time that inhibitory control and selective sustained attention – the ability to maintain focus in the presence of other stimuli – become more advanced and serve as important skillsets for young children as they enter toddlerhood.

Joint Attention In addition to selective attention, joint attention, or the ability to coordinate attention with another person toward a stimulus, begins to emerge within the first 6 months. Joint attention is characterized by behaviors that reflect two abilities: (1) following the gaze and gestures of others to a stimulus, also known as responding to joint attention, and (2) using gestures and eye contact to direct others' attention to a stimulus, or initiating joint attention (Mundy, 2016). Moreover, joint attention has been found to facilitate the development of language, information processing, learning, and social relationships in infancy and early childhood.

Environmental Influences on Attention Development

Context-Level Factors Variation in early environments has been examined with regard to the development of attentional skills. Early cultural experiences such as observational learning interactions in specific Indigenous communities have been shown to shape differences in children's attention (Silva et al., 2010). Attentional expertise in these communities begins in toddlerhood and continues to develop in line with the cultural values of being alert and being prepared to help others (Rogoff et al., 1993). In contrast, research conducted in the United States with White middle-class samples has been focused on home-level experiences that have been associated with lower attentional abilities throughout childhood, such as household overcrowding, noise, and difficulty maintaining clear routines (i.e., household chaos) or inadequate access to nutrition and educational resources thought to simulate early cognition (Guo & Harris, 2000). Indeed, these early experiences of adversity have been linked to lower sustained attention during the first year and a half of life (Brandes-Aitken et al., 2019).

Process-Level Factors Maternal parenting behaviors during infancy have been regarded as particularly salient in children's developing attentional abilities. Warm and sensitive behaviors, such as responsiveness to infants' verbal and behavioral cues, provide the emotional support and scaffolding needed to develop attentional skills and to set the stage for development of higher levels of sustained attention growth during early childhood (Graziano et al., 2011). Negative maternal behaviors (e.g., hostility and intrusiveness) are thought to hinder children's attentional abilities as these behaviors are likely to be demanding, overwhelming, and frustrating for young children, thus minimizing opportunities for children to practice sustained attention.

Perception Development

Just as sustained attention in infancy is thought to reflect information processing, infants' and children's *perception* is thought to serve as a foundation for later cognitive skills that are implicated in information processing models. Perception includes vision, audition, taste, and smell that simultaneously provide information from the environment. Researchers have demonstrated that perceptual development begins as early as the prenatal period and continues to mature with experience over time as individuals interact with and learn from others. Here, we focus primarily on visual perception of events, objects, and people in children's environment.

Developmental Considerations and Change Over Time

The ability to process information about the external world begins during the prenatal period, as illustrated by DeCasper and Fifer (1980) when newborn infants as young as 3 days old demonstrated a preference for their mothers' voice. Moreover, contemporary research has shown that during the third trimester, human fetuses demonstrate a preference for face-like visual stimuli, as indicated by greater head turning toward face-like configural stimuli (Reid et al., 2017). The capacity to process information progresses rapidly during the first few months of life; by 4 months of age, infants can process information about faces and behaviors (Libertus et al., 2017; Pascalis et al., 2002). Like attention development, perceptual development is influenced by intrinsic and extrinsic factors throughout infancy and early childhood. Intrinsically, sensory cortical and subcortical areas of the brain exist by the start of the third trimester of pregnancy. After birth, brain regions, neural connectivity, and the retina develop rapidly and the capacity to detect, evaluate, select, and interact with social stimuli grows.

Face Processing Although vision is relatively poor at birth, infants have been found to show visual preferences for two-dimensional stimuli and contrasting patterns, colors, and shapes as early as the first few weeks (Macchi Cassia et al., 2004), and by 6 months infants are able to process upright and inverted faces (Di Giorgio et al., 2012; Pascalis et al., 2002). Moreover, there is evidence that infants show preferences for faces over nonfaces early in infancy (Libertus et al., 2017). Typically, face preference and recognition are assessed using familiarization procedures and eye-tracking methods to assess where infants look and for how long. However, researchers have also utilized neurophysiological measures and have shown that like adults, young children demonstrate preferences for face-like patterns via activation of event-related potentials (ERP) in the occipitotemporal cortex (de Haan et al., 2002). Indeed, researchers have found that infants and young children showed greater amplitude in ERP to human faces rather than toys or monkey faces (de Haan et al., 2002) and to negative facial emotion expression relative to happy emotion expression (Aran et al., 2022). It is believed that this reflects early signs of sensitivity to human faces and negative emotions during infancy.

Infants become adept at processing faces early, and thus questions were raised to address if infants and young children show visual preferences for certain types of faces based on various characteristics (e.g., race/ethnicity, gender, and attractiveness; Chien et al., 2016). Although newborn infants do not show visual preferences for own-ethnic group or other-ethnic group faces, by 3 months there is a preference for own-group faces (Chien et al., 2016). Furthermore, there is evidence of plasticity with visual preferences during early infancy; the work of Sangrigoli and de Schonen (2004) demonstrated that 3-month-old infants who could not previously discriminate between other-race faces were successful after being familiarized with other-race faces multiple times. Importantly, this highlights that facial perception during infancy is highly malleable to experience. Indeed, in one natural experiment, Singarajah et al. (2017) demonstrated similar patterns of visual attention to Black, Hispanic, and White faces in Hispanic and White 11-month-olds – such that both groups of infants were more likely to show greater attention to faces that reflected the White majority group in the United States – despite their differential exposure to racially and ethnically diverse communities. These findings suggest that infants may be sensitive to a more broad racial and ethnic community than their immediate family – and are important because facial preferences shown in early infancy have been found to carry forward beyond infancy into childhood and adulthood.

Self-Perception Researchers have posited that infant perception lays a foundation for early self-awareness. Early in life, infants use visual information to learn and understand their own movements (i.e., visual proprioception). Through experiences with their environment children

learn to distinguish the self from other people and objects. Mirror self-recognition (MSR) is an established method for attempting to measure physiological and cognitive self-awareness by making a mark on infants' noses to see if they respond (touch their nose) when they see their reflection. Early research found that by 3 months, infants are attentive to the image present before them and at approximately 9 months they can show awareness when the image of themselves moves (Bertenthal & Fischer, 1978) by searching behind the mirror for the image. It is not until infants are about 18 months that they are able to respond to the mark made on their noses measured by the touching of the nose, indicating infants' capability to see self from an objective point of view (i.e., the mirror). More recently, scholars expanded the mirror-face-recognition task to also include the mirror leg-recognition task (Klein-Radukic & Zmyj, 2020) and other scholars use a tactile-localization task (Leed et al., 2019) to determine the role of visual cues in the development of self-recognition. Most importantly, due to the prevalence of technology, researchers have now begun using a video-recognition task and have found that video-recognition does not develop till the ages of 2–3 (Klein-Radukic & Zmyj, 2020).

Spatial Perception and Understanding the Physical World A key focus of cognitive scientists has included investigating infants' understanding about objects and the physical world. Very early on, infants are able to understand objects and events, and this facilitates the development of more complex cognitive processes (e.g., object tracking and object representation; Baillargeon, 2008). One of these processes is spatial perception, or the ability to understand surrounding objects and the relative position of objects to each other. Spatial perception is typically assessed using looking time paradigms (e.g., violation-of-expectation tasks and habituation procedures) to assess infants' reactions to unexpected events and infer what infants understand.

Building on their rudimentary physical-reasoning system, as infants age, their ability to understand the nature of objects increases. Newborn infants do not view objects as whole or having boundaries, but around the age of 2.5 months infants are increasingly able to recognize object continuity (i.e., an object is the same regardless of how it is viewed) with assistance, and at 4 months can demonstrate spatial completion (Aguiar & Baillargeon, 1999; Anderson et al., 2018; Baillargeon et al., 2012). Similarly, with age and greater experience with the social world, infants begin to understand that objects are permanent in time and space whether an individual perceives them or not (Bjorklund, 2022). By the end of the first year of life, infants can combine motor and spatial abilities to search and reach for objects during experimental tasks (Marcovitch et al., 2002; Perez & Feigenson, 2022), and can search and find hidden objects by the age of 2 (Behne et al., 2012). In sum, children understand simple characteristics about objects very early in life and their ability to understand more complex cognitive processes increases as they gain more experience with their surrounding environment.

Environmental Influences on Perception Development

Context-Level Factors Researchers have found that environmental contexts play a significant role in the development of children's perceptual skills. Consider, for example, evidence of the role of environmental factors on young children's emerging visual preference for own-race faces. Findings from studies on transracial adoption highlight that Asian infants adopted by White parents exhibited visual preferences and recognition biases for White faces instead of Asian faces (Sangrigoli et al., 2005). However, these results depended on the *amount of exposure* children had to White faces. Furthermore, recent research suggests that exposure to other-race faces may delay the onset of own-race face preference. During experimental investigations, White infants

exposed to racially heterogeneous faces were better able to discriminate between faces from a different racial group (Sangrigoli & de Schonen, 2004). Moreover, Gaither et al. (2012) found that monoracial White and Asian infants raised in racially heterogenous environments were better able to distinguish between other-race faces at 3 months. Similar findings were seen cross-culturally when comparing British White 5- and-6-year-old children living in a monoracial society and Malaysian Chinese 5- and- 6-year-old children living in a multiracial society (Tham et al., 2017). Therefore, visual perception and preference may be influenced by the ethnic-racial composition of infants' early environments.

Process-Level Factors Although some developmental theories have focused primarily on *positive* and *supportive* developmental processes between children and stimuli or partners in their environment (Bronfenbrenner & Morris, 2006), these everyday interactions may also lead to maladaptation. One area of inquiry has examined the role of child maltreatment on perceptual development, emphasizing how experiences shape how individuals encode, interpret, and respond to social stimuli (Cicchetti & Rogosch, 2018). Indeed, parent–child interactions characterized by abusive behavior have been linked to children's ability to distinguish between facial cues and expressions: children who experienced abuse were more liberal in selecting *angry* faces from emotion stimuli (Pollak et al., 2000). Physical abuse may heighten children's awareness of anger specifically, as experiences of abuse can include verbal and nonverbal expressions of anger by the abuser. Maltreatment, in the form of parent–child abusive interactions, has been linked to social-cognitive representations of relationships and surrounding contexts (Cicchetti & Rogosch, 2018).

Memory

Attentional and perceptional competencies support other complex cognitive processes such as memory. Until the 1980s, it was widely assumed that infants were incapable of forming and retrieving memories since most adults recall few memories prior to 3–4 years of age. Early cognitive researchers believed that even when young children remembered events, they were poor mnemonists who were unable to organize memories effectively (Bauer, 2002). Advancements in measurement tools (e.g., conjugate reinforcement and imitation) and neuroscience have demonstrated that infants can encode and retain information from their environments. The years between birth and age 5 mark a significant period of growth in children's emerging memory abilities, including autobiographical and deliberate memory skills.

Developmental Considerations and Change Over Time

Memory behaviors are apparent within the first few days of life. In fact, the results from numerous studies indicate differences in newborn infants' behavioral responses based on in utero experiences. For example, DeCasper and Spence (1986) used an operant-choice task to determine if newborn infants exhibited a preference for a prose passage recited by their mothers during the last 6 weeks of pregnancy compared to a novel text. They discovered that the recited passage was a more powerful reinforcer for infants exposed prenatally to the passage, indicating that newborn infants are capable of retention.

Conjugate Reinforcement During early infancy, children also display memory behaviors in response to operant conditioning tasks (e.g., *conjugate reinforcement* using a mobile or train, see Rovee-Collier & Hayne, 2000). Researchers measure baseline behavior (before the introduction of the stimulus), introduce an action-controlled object (e.g., a mobile that moves while kicking), and subsequently measure behavior after a delay. If the child performs at a frequency above their baseline rate, memory recognition is inferred. At 2 months old, infants can retain training for at least 24 hours (Hayne et al., 1986) and by 6 months training effects persist for up to 2 weeks (Hill et al., 1988). Like visual recogni-

tion memory, the length of retention and speed of learning increase with age. Moreover, differences in the task parameters such as the length of the training session can alter memory performance and the specificity of infant memory is connected to the learning environment signifying a lack of flexibility in infants' memory abilities (Rovee-Collier & Hayne, 2000).

Imitation Across the first year of life, infants also develop the ability to remember and imitate a series of actions (known as imitation tasks). During elicited and deferred imitation tasks, an action or series of actions is modeled by an experimenter. Then the subject is either instructed to imitate the action directly after the modeling, later followed by an imposed delay (*elicited imitation*) or only after a delay period (*deferred imitation*). At 6 weeks, infants can imitate facial expressions after a 24-hour delay (Meltzoff & Moore, 1994). By 6 months, infants can imitate part of a three-step sequence after a 24-hour delay period (Barr et al., 1996) and with training, 9-month-old infants can recall target actions up to 5 weeks later (Carver & Bauer, 1999). Around 9 months of age, infants begin to recall temporally ordered events (Carver & Bauer, 1999) and like other nonverbal tasks, with age, infants can retain ordered events for longer durations.

Notably, across all three types of tasks (visual recognition memory, conjugate reinforcement, and imitation), researchers have found that reminders can also increase memory performance. As children age, the retention interval increases following a reminder, there is a decrease in the amount of necessary exposure time for the reminder to be effective, and children are less reliant on the specificity of a reminder to benefit from its use. Nonverbal infants' early memory skills increase with age as their abilities to encode improve, and retrieval becomes more enduring and less reliant on context.

Verbal Memory The transition from infancy to early childhood marks a shift in memory expression from nonverbal to primarily verbal. The ability to discuss memories increases with age; however, young children often have difficulty providing verbal reports. For example, Simcock and Hayne (2003) found verbal recall in 2- to 4-year-old children lagged behind verbal skills suggesting that even when children had language abilities, they still relied more heavily on nonverbal memory representations. Several studies indicate that the form of memory expression (verbal or nonverbal) is correlated with language development at the time of encoding. However, some researchers have found that children with limited verbal abilities at the time of encoding were able to recall events verbally (potentially recoding the event; Bauer et al., 1998), though this appears to be linked to high contextual support.

As language abilities increase, young children begin to refer to the past spontaneously and discuss memories when prompted by adults (MacDonald & Hayne, 1996). The preschool years are a time of significant growth in early episodic memory. Early verbal reports are often incomplete and missing details but as children age, they can more accurately remember event details such as what and where. Additionally, young children tend to remember familiar reoccurring events accurately. There is evidence that preschool-aged children begin to organize routine information into scripts (a general understanding of the temporal structure for specific events) in a manner similar to adults (Hudson & Mayhew, 2009).

Autobiographical Memory *Autobiographical memory* is defined as both a specific memory of a past personal experience (Nelson & Fivush, 2004) and the integration of these recalled events to form a personal history. Fivush (2011) argues that autobiographical memory has many overlaps with general episodic memory but is distinguished by its reliance on autonoetic consciousness and the ability of individuals to not only remember events but represent themselves in past experiences. Thus, self-knowledge is a significant predictor of children's autobiographical memory (Ross et al., 2020). Furthermore, numerous cultural factors (e.g., language, physical

environments, values, and beliefs) shape the content, form, and function of memories (Ross & Wang, 2010; Wang, 2018). This form of memory develops gradually between the ages of 2 and 5 (Nelson & Fivush, 2004) in concert with the acquisition of language skills and an emerging sense of self. As a result, it is only fully developed at the end of early childhood. Across early childhood, autobiographical narratives increase in length and breadth, become more coherent, children focus more on novel aspects of events, and provide more orienting, evaluating, and contextualizing details.

Deliberate Memory Cognitive researchers initially believed that young children had poor *deliberate memory* skills (i.e., conscious strategies employed by individuals in the service of remembering) because these actions are not often linked to improved recall performance until middle children. However, research findings have provided evidence indicating that preschool-aged children and even toddlers can respond to memory demands and intentionally work to remember information. DeLoache et al. (1985) discovered that children as young as 18–24 months engaged in more strategic behaviors (e.g., verbalizing and pointing) when a memory demand was used (e.g., asked to find a hidden toy) than in the absence of a memory demand. Furthermore, experimental work has demonstrated that children under the age of 5 can learn and adopt strategic behaviors through training; however, recall and strategy use are only consistently correlated later in development. Therefore, young children can be deliberate and strategic in their attempts to remember; however, the payoff of strategy use may only be realized with increased age and experience.

Environmental Factors on Memory Development

Context-Level Factors Memory performance during infancy and early childhood has been examined as a function of external factors. Specifically, environmental risk in the form of traumatic experiences during early childhood (child maltreatment and specific events such as natural disasters) has been correlated with differences in memory accuracy and the level of detail in memory representations of stressful events (Goodman et al., 2019). However, the direction of these findings is inconsistent, with some individuals recalling stressful experiences with high levels of accurate detail, while others are prone to frequent memory errors. It is possible that other factors present during the initial experiencing of specific events (i.e., *encoding*) as well as during the *retrieval* process may play a role in the accuracy of memory reports, such as parental attachment styles and maternal support.

Process-Level Factors Significant attention has been paid to the role of parent–child conversations about the past (i.e., reminiscing conversations) in autobiographical memory development (Nelson & Fivush, 2004). Specifically, differences in the linguistic styles of parents in these everyday conversations have been a unique predictor of children's memory reports (Fivush, 2011). Children of mothers who use more elaborations (introducing a new event or aspect of the event or adding information) compared to repetitions (repeated information during the conversation) provide greater memory responses. Similarly, joint talk as events unfold has been associated with children's recall of the experience 3 weeks later (Haden et al., 2001). Recent research has also connected parent–child reminiscing conversations to children's deliberate memory skills, and strategic study behaviors. For example, children of mothers who used more mental state terms (think, know, etc.) when they were 30 months engaged in more strategy behaviors at 42 months (Rudek & Haden, 2005).

Theory of Mind and Metacognition

In addition to storing and retrieving memories, young children also develop an awareness of their own thinking. Two distinct but interrelated lines of research – theory of mind and metacogni-

tive development – have investigated children's knowledge and understanding of cognition (Flavell, 2000; Papaleontiou-Louca, 2019). *Theory of mind* (ToM) is children's knowledge of the mental world specifically early comprehension "about our most basic mental states—desires, percepts, beliefs, knowledge, thoughts, intentions, feelings, and so on" (p.17, Flavell, 2000), whereas *metacognition* is defined as "as any knowledge or cognitive activity that takes as its object, or regulates, any aspect of any cognitive enterprise" (p.104, Flavell, 1985). Despite differences in research traditions several studies provide evidence of a linkage between early ToM competencies and metacognitive knowledge in preschoolers (e.g., Ebert, 2015).

Developmental Considerations and Change Over Time

Theory of Mind and Metacognitive Knowledge During the second and third years of life, children develop the ability to talk about mental states (e.g., know, think, forget, and remember). Children's use of mental state terms increases across the toddler and early preschool years. However, understanding and differentiation of different terms occur later and becomes more reliable with age. Special attention has been paid to children's understanding of knowing and how the ability to attribute mental states to others develops across childhood.

A large body of research has focused on false-belief understanding – when children recognize that an individual may hold and act on an incorrect belief. Initially, researchers believed this ability emerged during preschool since most 4-year-old children can correctly answer direct questions during elicited-response tasks. However, more recent investigations using spontaneous-response tasks (e.g., violation-of-expectation and anticipatory-looking) suggest that false-belief understanding may be present in toddlers and infants (younger than 24 months). Across numerous studies, researchers have found evidence that there may be conceptual continuity in false belief understanding across infancy and early childhood, early nonverbal, preconceptual abilities (e.g., mentalistic reasoning) may facilitate later conceptual understanding of cognition. However, whether implicit and explicit false belief performance is directly linked remains unclear.

Researchers have also linked false-belief understanding to other forms of metacognitive knowledge. Specifically, Ebert (2015) found that false-belief understanding was associated with metamemory (i.e., children's understanding of memory processes) during the third year of life and early ToM understanding predicted later metacognitive knowledge beyond confounding variables, such as language and early metamemory knowledge. Additionally, using an experimental investigation Lecce and Bianco (2019) found that children who participated in a ToM training had higher levels of metamemory than a control group. Notably, this relation was mediated by their first-order false belief understanding, specifically the ability to think about their own and others' mental states. In addition to developing ToM understanding, children aged between 3 and 5 can discern between relevant and irrelevant memory variables. By kindergarten, children understand basic aspects of memory, such as the role of study time, and have some knowledge of the differences between memory tasks. However, knowledge about memory strategies, particularly causal relations, is limited before school entry, and continues to improve across childhood.

Metacognitive Processes In addition to acquiring metacognitive knowledge, children also develop the ability to regulate and control their thinking through metacognitive *control* (strategies used to optimize current performance) and *monitoring* (regulation of ongoing mental processes) skills. Researchers have used several novel tasks, including nonverbal measures, to capture precursors of procedural metacognitive abilities in young children. In the first 2 years of life, infants show rudimentary evidence of error monitoring, reflected in greater levels of persistence after selecting a correct response and

changing behaviors more often after incorrect choices (Goupil & Kouider, 2016). Additional studies have indicated uncertainty monitoring in children aged 3 or younger when given the option to ask for help nonverbally (Goupil et al., 2016), withhold responses (Lyons & Ghetti, 2013), and skip difficult trials (Bernard et al., 2015). However, young children struggle with calibration and tend to overestimate their cognitive performance. As with other cognitive abilities, there are age-related improvements in metacognitive monitoring across the preschool years and relative accuracy is achieved around age 8. However, metacognitive control skills continue to develop during the later elementary school years.

Environmental Factors on Theory of Mind and Metacognitive Development

Context-Level Factors Like other cognitive domains, researchers have investigated the role of socioeconomic disparities in theory of mind and metacognitive development. Devine and Hughes (2018) found a statistically significant positive association between socioeconomic status (SES) and false belief understanding in preschool-aged children. Notably, Pears and Moses (2003) discovered maternal education was a unique predictor of theory of the mind performance, separate from other socioeconomic markers (e.g., income and occupation). Although the mechanisms through which SES may influence early metacognitive skills are unclear, parents' education level has been associated with their use of metacognitive questions in parent–child interactions (Thompson & Foster, 2014). Thus, socioeconomic indicators may contribute to cognitive development through parenting behaviors.

Process-Level Factors There is a clear association between parenting practices and children's theory of mind development and early metacognition. Longitudinal studies have confirmed that parents' use of mental-state terms is predictive of children's use and comprehension of these terms (Moore et al., 1994). Moreover, studies in both eastern and western cultures have supported the link between parental mental-state talk and children's false belief understanding (Devine & Hughes, 2018). Furthermore, mirroring memory research, parents' elaborative style (i.e., use of rich details and open-ended questions) is positively associated with children's theory of mind performance (Ontai & Thomson, 2008).

In addition to parent–child language exchanges, researchers have also investigated other parenting practices that support the development of these cognitive abilities. Stern and Hertel (2022) found that mothers' autonomy supporting behaviors during a mother–child interaction predicted preschoolers' use of metacognitive strategies (planning, monitoring, and evaluation) while engaged in an independent problem-solving task. In contrast, coercive discipline (e.g., physical punishment and yelling) has been found to be negatively associated with false belief understanding (Pears & Moses, 2003). Therefore, discipline and other parenting approaches may play a role in the acquisition of theory of mind and metacognitive skills during early childhood.

Executive Function and Self-Regulation

Just as children's metacognition emerges in early childhood, children's executive function (EF) and self-regulation (SR) emerge and continue to develop across the lifespan. These skills have similar developmental trajectories, theoretical features, and neuropsychological correlates as metacognition; however, researchers have primarily used subcomponents of EF to explain individual variability in metacognition and other cognitive processes (Roebers, 2017). Although definitions of EF and SR vary, these constructs are sometimes regarded synonymously with one another, specifically when describing children's ability to engage in goal-directed behaviors, focus attention, and engage in higher-order cognitive processes thought to serve successful learning and adaptation.

Executive function is a set of higher-order cognitive processes that allow for individuals to plan and execute goal-directed behaviors. Indeed, regarded as a foundational skill for a variety of child outcomes, executive function has been linked to later school readiness (Blair, 2002), academic achievement (Ahmed et al., 2019) mental health (Pauli-Pott & Becker, 2011), and physical health (e.g., Reinert et al., 2013).

Developmental Considerations and Change Over Time

Despite a rich literature covering theoretical underpinnings, empirical findings, and the reliability of current EF measures, a strong debate persists surrounding working definitions, valid indicators, and the ecological validity of assessments. There are also different definitions and descriptions of the ways in which EF develops over time—with some evidence suggesting that EF is malleable across a considerable portion of early childhood (Crone & van der Molen, 2007), some suggesting that malleability is limited to a critical period (Garon et al., 2008), and some suggesting that EF skills are largely heritable (Friedman et al., 2008). However, the most widely accepted definition of EF includes three distinct but related subcomponents (Friedman & Miyake, 2017; Miyake et al., 2000): *working memory* (updating), *inhibition* (inhibitory control or effortful control), and *shifting* (set-shifting or cognitive flexibility). The subcomponent of working memory refers to the monitoring and updating of information or representations in one's mind short term to assist in the completion of a certain task or goal (Miyake et al., 2000). Around 8 months of age, indicators of *working memory* emerge, such adapting reaching behaviors to successfully navigating around obstacles (e.g., learning to reach around a barrier to reach a toy). Accordingly, the amount of information children can hold in their mind increases significantly between ages 3 and 5 to further assist in the completion of tasks (Garon et al., 2008). *Inhibitory control* is the ability to stop an automatic or dominant response to a task or stimulus (Miyake et al., 2000). Precursors to inhibitory control emerge around age 2, and by age 3, children demonstrate inhibitory control in more complex tasks (Garon et al., 2008). Finally, *attentional control (or shifting)* involves the active switching of attention from one task or operation, to another (Miyake et al., 2000). This component is often measured in terms of shifting rule sets, which occur when a child is presented with one rule and is then asked to shift their attention to another rule. Emerging between ages 3 and 5, children can demonstrate shifting when they are able to reliably switch from one rule (e.g., sorting by shape) set to another.

From a developmental perspective, an extant literature has highlighted the differentiation of EF components as children mature. Starting out as a unitary construct in early development, EF subcomponents exhibit a slow differentiation, with two factors emerging in preschool and early elementary school (inhibition and working memory; Viterbori et al., 2015). It is only later in development that subcomponents of inhibition, working memory, and shifting are empirically distinguishable.

Early Regulatory Skills Executive function in early childhood has been empirically linked to behavioral skillsets thought to comprise self-regulatory behavior, such as the ability to sit still, follow directions, and remain engaged in learning activities. However, precursors to cognitive regulatory behavior in early childhood are thought to be rooted in social-emotional developmental milestones in infancy and toddlerhood (Feldman, 2009). For example, self-regulation in infancy has been primarily studied in the domain of emotion regulation – guided by the understanding that regulation is a dynamic system of physiological, emotional, attentional, and cognitive processes. A developmental hierarchical-integrative perspective posits that physiological, emotional, attentional, and self-regulatory functions develop on top of each other in a bottom-up fashion. Therefore, it is understood that lower physiological systems support the emergence of higher-order mechanisms of cognitive control (i.e., executive function) as individuals transition

from infancy to early childhood (Feldman, 2009) Indeed, most models of self-regulation propose that the engagement of higher-order processes, such as attention control and language-mediated reasoning, can delay, minimize, or end the enactment of prepotent responses – such as frustration when a goal is blocked (Cole et al., 2019). For example, commonly demonstrated in "wait tasks" administered to children ages 2 and older, when presented with a blocked goal such as a broken toy, early self-initiated strategies (e.g., distract, self-soothe, and seek information) resulting from prepotent responses (e.g., frustration, anger, and sadness) are regarded as indicators of emotion regulation. These same strategies can also serve as examples of cognitive and behavioral self-regulation in children ages 3 and older (e.g., asking for help from a parent and seeking information in order to solve a problem). These early indicators of emotion regulation are thought to be preceded by co-regulation processes between caregivers and infants (Cole et al., 1994). Indeed, an infant's first problem-solving context is often the ongoing coordination of emotional exchanges with their caregiver. Given that the complexity in dynamic regulatory systems increases over time (to include emotional, behavioral, and cognitive regulation), and that these systems self-organize from both subcomponents and context, regulatory systems are not predetermined but emergent given the context.

Environmental Influences on Executive Function and Self-Regulation

Context-Level Factors With increasing evidence that self-regulation plays an important role in children's later school adjustment and success, there has been some focus on understanding contextual factors, particularly in the early classroom environment, that may play a role in the development of aspects of self-regulation and executive function in early childhood. There are some early indications (e.g., Salminen et al., 2021) that the preschool experience plays a role in children's developing inhibitory control and working memory.

The home environment is a significant context for the development of EF and SR skills prior to formal school entry. There are several studies positing that *household chaos* – the level of instability, disorganization, and overstimulation in a home – is negatively associated with children's regulatory behaviors. For example, studies have supported a direct pathway between household chaos and EF in which they suggest that young children may withdraw from a chaotic home environment and would, therefore, be unable to benefit from scaffolding and other supportive parenting practices that can promote early regulatory behaviors (Evans et al., 2005). Indeed, the role of household chaos in children's early development of these skills is pronounced when comparing it to other predictors of later EF. Studies have demonstrated the unique effect of household chaos on EF above and beyond markers of poverty (Vernon-Feagans et al., 2012).

Process-Level Factors Another set of studies have highlighted pathways from parenting behaviors to early EF and SR development. Across multiple investigations, parental warmth has been linked to better attentional regulation and inhibitory control. Jennings et al. (2008) found maternal warmth at 20–27 months positively predicted self-regulation in later toddlerhood (at 34 months). Additionally, high levels of intrusive parenting (characterized by overly domineering actions) are associated with poorer attention focusing and response inhibition. Around ages 3, 4, and 5, specific parenting practices – such as playing concentration games – have also been predictive of children's EF over and above other components of the broader home learning environment (Korucu et al., 2019). Indeed, socialization practices such as parent–child interactions play a critical role in the development of early EF and regulatory skills.

Other Contextual Considerations

In this chapter, we have described early cognitive development across several key areas: attention, perception, memory, theory of mind, metacognition, executive function, and self-regulation. Though we briefly highlighted some context-level influences and family-level processes, we recognize that other significant proximal and distal contextual factors are related to the development of early cognitive abilities. Most notably, development is embedded within cultural contexts. Culture encompasses beliefs, symbols, values, rituals, and customary activities. Researchers have used cross-cultural work to examine between-group differences in cognitive abilities; however, the influence of culture on cognition occurs at every level of analysis—individual, dyadic, group, situational, and temporal (see Wang, 2018). As such, all cognitive development must be understood within cultural contexts.

Summary and Key Points

The first 5 years of life represent a significant period of cognitive development across multiple domains. Infants are born with many rudimentary cognitive abilities that improve with age, allowing children to perform more complex tasks and display greater levels of effortful control over their cognition. These changes are the result of both internal (e.g., neurological maturation) and external processes (e.g., social interactions). Although researchers' understanding of the mechanisms underlying cognitive development is limited, parenting behaviors characterized by warmth, sensitivity, responsiveness, and elaborative conversations are associated with positive developmental outcomes. Additionally, environments with risk factors such as limited access to resources, instability, and child maltreatment are linked to poorer cognitive performance during infancy and early childhood. Scholars have taken notable strides in understanding early cognitive development, yet there are still areas of opportunity to continue to advance the field through increased transdisciplinary work, a focus on development within social contexts, and translation of research into practice, prevention, and intervention.

In recent years, cognitive developmentalists have started to move beyond questions concerning *what* is developing to *how* and *why* development occurs. One way to help elucidate mechanisms of change is through collaboration across scientific fields. As Gottlieb (1991) suggested, development occurs across multiple levels, as such, research would benefit from the simultaneous investigation of epigenetic influences, neural correlates, and environmental factors. A concurrent focus on behavioral observations and neuroscientific measures of cognition may provide additional insight into when and how children advance in their cognitive abilities. Focusing on multiple domains will further our understanding of individual differences in cognition across the first 5 years of life.

Of course, cognitive processes are embedded within numerous contexts. Prather (2022) cautions against making assumptions about the universality and generalizability of cognitive findings without attending to the specific social and cultural environments within which research findings emerge. Thus, future work may place context at the forefront and explore questions that focus on under what circumstances children acquire different cognitive abilities. This includes acknowledging interactions between *more than one* ecological environment on human development (Bronfenbrenner & Morris, 2006). For example, the home is known to have significant direct effects on cognitive development; however, it is embedded within larger demographic and social landscapes. Neighborhood contexts, including socioeconomic status, safety, support, and access to resources, can also directly and indirectly relate to children's cognition. Moreover, families' lack of access to institutional resources has been linked to higher economic hardship and psychological distress, ultimately predicting lower levels of cognitive abilities in children. Moreover, a multilevel analysis approach can be used to examine how cultural influences are associated with cognitive development at individual, community, and societal

levels (see Wang, 2018). This includes examining relevant social, political, and historical factors such as society's increased dependence on technology and how these advancements may influence development.

Although there has been some degree of focus on the importance of cultural and contextual factors for cognitive development reflected in the literature for some time (Rogoff et al., 1993), a more recent focus on context includes a broader transition from lab-based studies to more naturalistic settings (e.g., informal learning environments). For example, recent work in museums has linked parent–child interactions to memory outcomes (Haden et al., 2021). Given the increasingly large number of children attending childcare and participating in preschool programs, it is also necessary to assess the role of out-of-home care and early education settings in the acquisition of cognitive skills. Recent research has linked preschool teachers' practices with children's autobiographical memory performance (Andrews et al., 2021), executive functioning (Salminen et al., 2021), and language skills (Weiland & Yoshikawa, 2013). However, the association between these settings and cognitive development remains largely understudied and is an important future direction for cognitive researchers.

The current body of literature indicates several important implications for practice, prevention, and intervention. Policymakers and practitioners should focus on supporting parents and families – especially those from historically marginalized populations. Interventions may target education regarding parenting practices, language exchanges, and creating safe environments with known associations to positive cognitive outcomes as well as building on the existing strengths of families. In addition to implementing new programs, policymakers should protect existing systems that are designed to minimize risk factors at local and national levels by providing access to financial and physical resources for families. Finally, researchers can support these efforts by continuing to identify additional risk factors and moderators to better prevent adverse developmental outcomes. Specifically, researchers should examine children's development as it exists within *context* using ecologically valid measures, providing information on the everyday lived experiences of infants and children.

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5 Infants' Contributions to Prelinguistic Conversations Drive Language Learning

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Communication Begins with Conversation

Conversations are communication exchanges between two or more people. They are a means to connect with another human, share ideas, and gain information about others and the world. A conversation is by definition a multidirectional exchange in which participants are sharing and receiving. They are an opening in a system, or a joining of multiple systems of organization (in this case, the individual human). Although it will be, on average, 12 months before a new human utters their first word in a conversation, and another 12 months in which they learn to wait for another speaker and respond in timely turn-taking exchanges of language and gesture (Kuchirko et al., 2018), babies enter the world ready to converse with their caregivers in back-and-forth exchanges of connection (Stern, 2018) and expansion of affective experiences that have their own rhythmic cadence (Trevarthen, 1999). This chapter focuses on the ways in which infants' own cues contribute to their conversations with caregivers' and elicit the responses that will advance their own development. We introduce the concept of *developmental sensitivity* as an explanation of the ways that caregivers adapt to these rapid changes in infants' cues to provide the types of feedback that infants need. This body of research is focused largely on infants and caregivers who can see and hear, which we acknowledge as a limitation, though there are many ways to communicate and converse responsively to support development. Although the literature is dominated by research on infant–mother interactions, many studies include both mothers and fathers. Further, there are notable studies focused on father–infant interactions showing that, like mothers, fathers' sensitive responses to infants are important for their language development, and other studies showing that key differences between father–child and mother–child interactions may provide unique ways to support language development. In addition, infants' interactions with non-parental caregivers, such as early child educators, also vary from those of parent–child interactions in important ways that are addressed later in this chapter when we discuss variation in caregiving contexts.

Far from passive recipients of adult speech, infants enter early conversations with a rapidly growing set of tools they use to respond to others, draw others attention, and enter into back-and-forth exchanges, or dialogs, with others. Infants'

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cries and coos signal their physical needs and desire to interact, their facial expressions, wiggles, and muscle tension give away internal states, and their gaze and eye contact indicate their attention and interests. Over the first year, facial expressions expand and vary to express more distinct internal states. Body language is harnessed as an intentional expression of desires, needs, and interests, and gestures emerge to communicate these intentionally (Crais et al., 2004). Gaze becomes a tool to gain, share, and direct others' attention (Tomasello, 2008). And vocalizations become increasingly varied and intentional as they move toward speech through stages of reflexive phonation (guttural noises), cooing, expansion (open vowel sounds), babbling, then words.

As caregivers (usually adults) respond to these behaviors, they invite infants into multimodal back-and-forth exchanges of experience, the start of conversations, and a driver of communication. Turn-taking, the essential characteristic that makes an interaction into a conversation, emerges early in infant-caregiver exchanges. Through affective exchanges of cycling emotional expression (through faces, bodies, eye contact, and sometimes vocalizations), infants come to experience intersubjectivity with caregivers through shared affective states (Hollich et al., 2000). These attuned interactions quickly build the infant's interpersonal interaction skills, including eye contact, gaze following, and imitation (Feldman, 2007). Experiences of intersubjectivity lead infants to recognize caregivers as communication partners, and motivate communication, not only to get their needs met, but also to share connected states of being, making conversation a goal in itself (Papousek, 2007). According to Hollich et al.' (2000) emergentist coalition model, the processes of word-learning progress from affective to social, then from cognitive to linguistic. And each phase requires different types of inputs from the child's primary communication partners, as well as different kinds of responses to the child's communication cues (Tamis LeMonda et al., 2001). But these are all built upon the foundations of conversation that connect children to their communication partners.

Developmental Sensitivity: The Shifting Nature of Contingent Responsiveness

Conceptually, contingent responsiveness to infant behaviors has been defined in many ways. Contingency embodies an immediacy or promptness of a response that the infant can detect (Bornstein & Manian, 2013). The immediacy component seems bounded by a two- to three-second window, which is short enough for the response to be detected and linked to the preceding behavior, but long enough to allow for a reply without interruption. Responses within this time window are salient to infants and support their learning (Van Egeren et al., 2001). Yet, caregivers are imperfect responders. Across a variety of infant ages and sociocultural contexts, caregivers tend to respond to approximately 63% of infant behaviors with a broad distribution of individual differences. This variability suggests a wide 'sweet spot' for supportive interactions. Further, both under-contingency and over-contingency have adverse outcomes. Infants react negatively when caregivers are disengaged and provide too little interaction, yet too much responsiveness is seen by observers as intrusive, and infants also find it aversive. Extremes in response rates in the first year predict insecure and disorganized attachments.

For many decades, and with good reason, the science of child development has forefronted the undeniable importance of parental responsiveness (prompt, sensitive, or attuned replies) in promoting early development, from foundational work on associations between attachment security and maternal responses to infants' cries to more recent work on language-learning (e.g., Tamis LeMonda et al., 2001), and has identified specific developmental effects of different types of responsiveness (e.g., Bornstein et al., 2008; Vallotton et al., 2017b). The field has shown repeatedly that when it comes to caregiver responses, by and large, more is better; at least if your analyses are within the broad window of optimal responsiveness, and if responsiveness is measured using the common blunt variables such as rate of responses per minute or ratio of infant

cues to caregiver responses. So how can there be such a thing as *over*-contingency? Because beyond just the response rate and timing, different infant cues call for different types of responses, and often even nonresponsiveness (i.e., silence, or lack of a detectable response to the infant). That is, there is a type of developmental sensitivity that caregivers may exhibit that, in the moment, may look *un*responsive (or less responsive), but is in fact, just the kind of response the infant needs.

Socially contingent interactions are both prompt and meaningful (Masek et al., 2021). Meaningful responses align with the infant's current state of attention and build in sophistication as infants develop. Researchers often conceptualize these behaviors as sensitive using macro-analytic scales or micro-analytic coding to examine the impacts of particular responses on infant learning. But even at the microanalytic level, measures often combine and oversimplify both the suite of infant cues and the many types of caregiver responses. A sensitive caregiver may rock and *shhhh* a crying infant rather than vocalizing a soothing response. They may distract a frustrated child by showing a shiny toy to divert their attention away from their frustration, rather than naming and discussing the child's emotions, which can perpetuate frustration. They may watch thoughtfully as an infant explores a new object with their hands and mouth. And they may listen silently as an older infant hums or makes open vocal sounds, waiting until the child makes a clearer word-like sound, or combines their vocalizations with a directed gaze, or a reach or point, before responding to the more developmentally advanced cue (Albert et al., 2018).

In this chapter, we bridge learnings from the literature using both the micro- and macro-approaches to consider the importance of moment-to-moment contingent responding nested within a system of *developmental sensitivity* (Fig. 5.1). We define developmental sensitivity as *responding that is prompt, aligned, and informed by an interaction history with infants' shifting cues and needs over developmental time*. Developmentally sensitive caregivers do not respond to all cues all the time (Bornstein & Manian, 2013), nor all cues the same way (Bornstein et al., 2008; Gros-Louis et al., 2006). Instead, developmentally sensitive caregivers respond in different ways to multiple infant cues in the current moment (Vallotton et al., 2017a) in the context of their interaction history (Vallotton et al., 2017b). They consider shifts in infants' cues that indicate their developmental phase and readiness for new types of input. While messy and imperfect, these developmentally contingent responses advance infants' development across domains.

Developmental Sensitivity in Cultural Context

In addition to the immediate context and developmental history, each caregiver is operating within their own cultural context of caregiving, which influences many aspects of infant–caregiver conversations, from macro-meanings to micro-behaviors. Culture shapes caregiving goals and priorities, such as the degree to which caregivers wish to promote children's autonomy, relatedness, and interdependence with others the degree to which they prioritize children's language development (e.g., Johnston & Anita Wong, 2002) and prompt children to speak up for their own needs versus anticipating and meeting needs in advance of infants' cues (Rothbaum et al., 2006). Thus, culture shapes the very nature of sensitivity and responsiveness within interactions in ways that shape language. It influences the relative amount of time caregivers will spend in proximal and distal interactions, such as those depicted in Fig. 5.1. It influences how caregivers' interpret children's cues how quickly they respond (Rothbaum et al., 2006), and the degree to which they direct infants' attention versus respond to infants' interests. Cultural context also influences the functions and content of caregivers' communication, including the relative frequencies of caregivers' speech to regulate infant behavior, refer to objects, or prompt infants to vocalize, the degree to which regulatory speech is framed positively or negatively, and the relative frequency with which caregivers talk or gesture in reference to infants' actions versus the objects

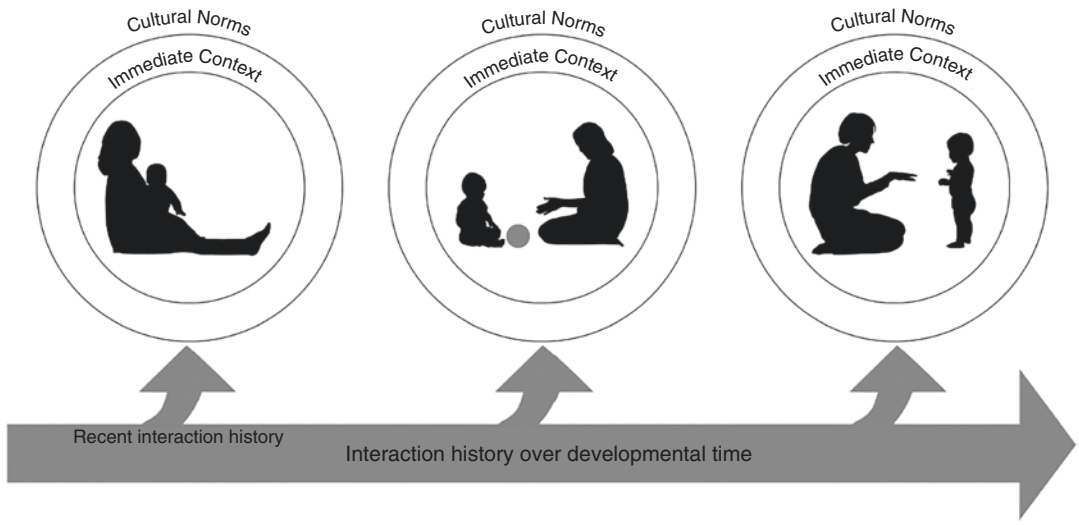

Fig. 5.1 Developmental sensitivity in context. Conversations are shaped by the immediate context of the interaction (inner circle) and cultural context of caregiving (broader circle). In dyad A, the caregiver holds the infant on their lap, modeling a proximal caregiving style in which the infant is kept close, communicating through touch and vocalization, but sharing less eye contact. Dyad B illustrates a distal interaction pattern in which caregiver and infant face one another and share attention on and communication about objects, facilitating development of joint attention as object exploration. In dyad C, the referential landscape has expanded further as the infant becomes increasingly mobile and both caregiver and infant can reference absent objects. The small arrows remind us that caregivers are responding to the immediately preceding interaction history on a smaller timescale (moments, minutes, or hours) that informs proceeding conversational turns. For example, the conversation in dyad B is built upon previous exchanges with the ball; and in figure C, both caregiver and infant could refer to a toy out of sight, if they both understand the referential common ground they share in their immediately preceding interaction history. As the child's memory and symbolic skills rapidly expand, the immediate interaction history to which they can refer will grow to hours and days. The larger arrow represents the inherited interaction history built up over developmental time (days and months). (Image created by Briley Cox)

on which they are acting (e.g., Wang & Vallotton, 2016). All of this cultural variation is then related to a host of infants' later communication and language skills (Wang & Vallotton, 2016) showing that these communicative interactions serve to transmit culture from one generation to the next.

Thus, developmentally sensitive prelinguistic conversations are subtly but rapidly shifting multimodal exchanges between the fastest learners in our species and the caregivers who are somehow instinctively keeping up with them and responding in ways that take into account the dyadic context in the moment, their culturally shaped priorities and goals, and their history of interactions indicating the child's growing communication skills in order to engage in iterative exchanges that meet the child's immediate needs and advance their development toward more mature communication. Caregivers are intuitive geniuses!

What Are Infants' Contributions to the Conversation?

Although scientists of infant communication and language learning tend to focus on just one or a small set of cue modalities, infants bring their whole bodies to the endeavor of expressing their states and needs and connecting with their caregivers, and their cues are inevitably multimodal (Bates et al., 1975). Although these modes are not yet fully coordinated and under the child's control, infants communicate their cognitive, physical, and affective states through facial expressions and muscle tone, body movements and vocalizations, which are typically all following the direction of their gaze. When they first begin to reach for an object of interest, they reach with all four limbs (and sometimes also their heads), looking toward, grunting, and straining

their whole body toward the object or person of their desire. As these different types of cues become more distinct (e.g., facial expressions become more clearly linked to different states; gestures become more refined as fine motor actions), infants' cues come under more of their control, and then become coordinated to elicit caregivers' feedback more intentionally. This coordinated multimodality is a signal that infants' behaviors are intended as communication cues (Bates et al., 1975). By 12 months infants not only increase the clarity of communication cues by using concurrent gestures and vocalizations, but also use them in a socially coordinated way. By 12 months, infants begin to intentionally combine gestures (i.e., pointing) and vocalizations to direct adults' attention to shared interests, specifically when they understand from eye gaze that the adult communication partner's attention is available (Igualada et al., 2015). Infants specifically use vocalizations to get adults' attention, or correct their attention, when adults are not already attending (via eye gaze) where infants want to direct their attention. Further, infants' abilities to use these social cues (i.e., eye gaze) to modify their own use of multimodal cues at 12 months is related to their later language development at 18 months (Igualada et al., 2015). Thus, infants' own attention and learning are guided by multimodality of stimuli and by the end of their first year, they, too, can use multimodal cues as intentional communicative acts to direct others attention and elicit feedback (in the form of adult communication) that supports their language learning.

Table 5.1 provides a general developmental timeline for infants' communication signals, the communication that these signals elicit from caregivers, the functions that caregiver feedback serves to support development, and the infants' social-emotional, cognitive, and language development processes that are supported by these communicative exchanges with developmentally responsive caregivers. That is, how infants' cues elicit and become part of conversational feedback loops that lead to language learning and a lot more. In the following sections, we first consider the infant communication signals that are noticeable to caregivers, focusing specifically on vocalizations and gestures, and what each elicits from caregivers. We then dive deeper to explore the developmental processes that these developmentally sensitive conversations facilitate in three domains: emotional (e.g., connection and regulation), cognitive (e.g., memory and attention), and language development (e.g., vocabulary and syntax).

Vocalizations

Vocal Development from Birth to First Words Infants actively contribute to communicative interactions from birth by producing prelinguistic vocalizations. Regardless of their ambient language, infants' prelinguistic vocalizations undergo dramatic experience-driven developmental change over the first year. The progression of infant prelinguistic vocalizations from immature grunts toward first words is best described by Oller's (2000) infraphonological coding system, which captures both perceptual and acoustic features of speech, such as vowel resonance and timing of consonant–vowel transitions. Infraphonology refers to a well-formed syllable's infrastructure and consists of four prelinguistic speech categories. In the first 2 months of life, infants are in the phonation stage, producing *quasi-resonant* vowels. Quasi-resonant vowels are vocalizations produced with a closed vocal tract (e.g., nasal vocalizations and grunts). Between 1 and 4 months of age, infants enter the primitive articulation stage and begin producing *fully resonant* vowels. Fully resonant vowels are vocalizations produced with an open vocal tract (e.g., [a], [o] and other coos). These early non-cry vocalizations, while independent from emotional state or context, allow infants to explore their vocal capabilities and experiment with the impact of their vocalizations on the social environment. Infants start producing marginal syllables during the expansion stage, which begins between 3 and 8 months. Marginal syllables consist of slow sequences of consonant–vowel articulation with long transitions between consonants and vowels. Finally, infants enter the

Table 5.1 Infants' contributions to conversations and their own development: Developmental phases of infant communication signals, caregiver communication behaviors and functions, and the developmental processes facilitated by infant–caregiver conversations

Age	Infant Communication Signals	Caregiver Communication Behaviors	Caregiver Communication Functions	Emotional Development Processes	Cognitive Development Processes	Language Development Processes
0–3 months	Cries; Facial expressions; Body language/wiggles	Infant-directed musical vocalizations; Facial expressions imitate and exaggerate infants' expressions	Meeting needs; Expanding and regulating emotions; Speech sound exposure with hyperarticulation	Comfort; Sense of safety	Response to stimuli (orientation of attention); Exploration	Statistical speech sound learning (phonemic discrimination)
3–6 months	Coos (vowels); Eye contact; Smiling	Infant-directed speech; Exaggerated facial expressions	Drawing attention to interaction and communication	Security; Emotion discrimination	Intentional actions; Exploration; Gaze following	Statistical learning (transitional probabilities)
6–9 months	Canonical babbling; Directed gaze; Joint attention	Infant-directed speech; Vocal "play"	Scaffold participation in social routines	Connection; Emotional regulation	Attention organization/ control; Imitation; Experimentation	Catalog of familiar speech sounds; Intentional turn-taking; Statistical learning (grammatical parsing)
9–12 months	Reduplicated and variegated babbling; First gestures (reach, show, wave, point); Triadic interactions; Gesture + vocal combinations	Infant-directed speech; Modeling and scaffolding social routines (speech, gesture); Simplified speech; Triadic joint attention	Organizing attention for word-mapping	Social referencing	Object permanence	Receptive vocabulary building; Fast mapping
12–18 months	First words; Pointing; Social gestures; Symbolic gestures; Socially coordinated gesture + vocal combinations; Gesture + speech combinations	Recast of child's speech; Elaboration in response to child speech and gestures	Word-mapping	Internal working models; Shared reference (to absent referent); Triadic interactions	Attention beyond here and now (absent referent); Deferred imitation	Receptive vocabulary building; Intentional communication "about"
18 months	Multi-word utterances		Conceptual development; Support for "grammar spurt"	Prosocial behaviors	Moving toward representation and abstraction	Expressive vocabulary building

canonical stage between 5 and 10 months of age and begin producing well-formed syllables. These *canonical syllables* are fully resonant vowels combined with faster consonant–vowel transitions (e.g., [ba], [da]). Infants exposed to consonant–vowel dominant languages produce disyllables that follow a [CV] pattern, while infants hearing languages with higher frequencies of [VCV] words produce more [VCV] disyllables. Caregivers perceive and classify the combination of multiple canonical syllables (e.g., [baba], [badadaba]) as babbling. As infants approach their first birthday, they begin to combine syllables to produce words, although infants still regularly produce all four prelinguistic speech categories well past their first birthday as their prelinguistic vocalizations gradually shift into words.

What drives this progression of vocal development toward more advanced types of speech is a combination of physiological and social factors. Some maturation of the vocal organs is necessary for infants to produce consonant–vowel syllables. However, social interactions through conversations with caregivers are necessary for and accelerate the progression of speech development. For example, deaf infants show a delayed onset of canonical babbling compared to hearing infants. Around 3 months of age, repetitive and rhythmic patterns of interactions emerge through coordinated gaze, touch, and vocal communication (Feldman, 2007), and have been described as having a musical quality (Trevarthen, 1999). This early synchronicity is most evident in vocal turn-taking, in which caregivers initially organize vocal interactions by coordinating their responses to alternate with infants' vocalizations. Between 3 and 5 months, infants test their voices and determine that their vocalizations, not just their cries, receive reactions from caregivers. This development goes hand in hand with the emergence of social smiling as infants learn that they can influence those around them in many ways. By 5 months, infants will actively work to re-engage with a caregiver who has stopped interacting with them by babbling more frequently (Goldstein et al., 2009). They learn the value of their vocalizations for interacting with the world and can instrumentally use their vocalizations to generate further social interactions.

In the second half of the first year, infants become more sensitive to the timing of caregiver feedback and will modify the qualities of their vocalizations in response to contingent input. Specifically, infants begin producing more vocalizations that contain common vowels (V), consonants (C), and disyllable patterns (e.g., CVCV) that match their ambient language. For example, infants rapidly produce more consonant–vowel syllables when caregivers respond to infant vocalizations by speaking consonant–vowel (CV) syllables (Goldstein & Schwade, 2008). However, infants non-contingently exposed to the same input do not modify their vocal production. Around their first birthday, infants begin arranging their vocalizations into recognizable words culminating months of prelinguistic conversations with caregivers.

Impact of Infant Vocalizations on Caregivers The social shaping of infant vocalizations from babbles to first words is possible because infants' prelinguistic vocalizations are highly salient to caregivers, capturing caregiver attention and prompting multimodal responses. Hearing caregivers are sensitive to and influenced by several cues in infants' vocalizations when deciding whether they will engage and how to respond. Mothers can differentiate and categorize vocalizations using the infraphonological properties and use those properties when asked to rate the vocal maturity of infants' vocalizations (Albert et al., 2018). Canonical syllables are perceived as the most speech-like, while caregivers rate quasi-resonant vowels as the least speech-like. Caregivers then implicitly use their perception of vocal maturity when determining whether or not to respond promptly to infant vocalizations. For example, by the time infants are 9 months old, vocalizations that are perceived as least speech-like (e.g., quasi-resonant vowels) are most likely to be ignored (Albert et al., 2018), while canonical syllables are more likely to receive a response. The vocal qualities of the babble also impact the type of information moth-

ers provide. The most common responses to vocalizations include describing and asking questions about what the infant is doing and acknowledging the vocalization with a conversational placeholder (e.g., "uh-huh"). But, canonical syllables are more likely to be imitated than other vocal types, where marginal syllables are more likely to elicit narrative responses (e.g., "You're so big" or "You're playing"). These differentiated response rates and types may create a developmental cascade and change infants' opportunities for learning as infants who produce more advanced syllables elicit more frequent responses and then become more likely to produce additional syllables in response.

Vocalizations are inherently multimodal, so beyond the vocal qualities, each vocalization is accompanied by infant gaze among seeing infants; although blind infants also orient their face toward objects and caregivers when vocalizing, and as first observed by Fraiberg (1975), selectively orient toward the voices of their preferred caregivers. Infants use eye gaze to aim their vocalizations in one of three ways: caregiver-directed, object-directed, and undirected. Caregiver-directed vocalizations are those produced while the infant looks at the mother's face. Caregivers are highly responsive to caregiver-directed vocalizations and their responses to these vocalizations in the first year are predictive of infants' rate of [CV] production from 8 to 14 months. Further, responsiveness to caregiver-directed vocalizations positively predicts vocabulary scores at 15 months where responses to undirected vocalizations were negatively correlated with vocabulary. As infants age, the frequency of caregiver-directed vocalizations decreases, and infants produce more vocalizations at objects.

Object-directed vocalizations are produced while the infant looks at an object held or within reach. In contrast, undirected vocalizations are produced at neither an object nor a caregiver, such as when infants vocalize toward an empty space. Regardless of vocal quality, vocalizations directed at objects are more likely to receive a response than undirected vocalizations (Albert et al., 2018), making object-directed vocalizations a highly salient cue to caregivers. Parental responsiveness to their 9-month-old infants' object-directed vocalizations predicts infants' language development at 15 months. This result may be because infants appear to be signaling a readiness, and even desire or demand, to learn when they vocalize at objects. At 11 months, infants learn word-object associations for objects labeled after a babble but not after a silent look. Object-directed vocalizations also elicit different types of information than undirected vocalizations. Caregivers respond to object-directed vocalizations with more sensitive and detailed information, such as descriptions (e.g., "That's a cup.") and questions (e.g., "Is that a ball?"). The vocalization provides a clear referent that can be labeled or discussed. In contrast, caregivers provide more narrative ("You're talking. You have so much to say today."), and affirmation responses (e.g., "Yeah,", "Uh-huh, I know.") to undirected vocalizations, perhaps to acknowledge the conversational attempt when infants are not attending to an object (Albert, 2021). Such differentiated responses demonstrate that infants direct their own learning by producing babbling in various ways and that caregivers are capable, not only of responding to infants' interests in the moment, but of tracking infants' developmental progress over time and sensitively aligning their responses to meet infants' current developmental needs. Infants with visual impairments adapt similar strategies to indicate directedness with touch and body orientation. These interactions cascade over multiple months, driving the infant's vocal production closer to first words, and then to the expansion of their vocabulary. For sighted infants, caregiver responsiveness to gaze-coordinated vocalizations predicts expressive vocabulary up until 24 months (Donnellan et al., 2020).

Caregivers also respond to variation in children's vocabulary. A study of fathers' child-directed speech to their 2-year-old children showed that fathers' lexical diversity (using a wider range of words, rather than repetitively using the same words) was predicted specifically by the children's language proficiency, including children's own receptive and expressive vocabu-

lary (Quigly & Nixon, 2020). Fathers' lexical diversity was not predicted by other social characteristics of the children, indicating that fathers were tuned in specifically to several aspects of their children's language development and adapting their own language in developmentally sensitive ways. This rich language stimulation from fathers specifically has been shown to support children's later expressive communication skills (Pancsofar & Vernon-Feagans, 2006).

Gestures

Gesture Development from Wiggles to Words In early communication, baby language is body language. As babies gain motor control, social awareness, and symbolic thinking, their use of their bodies to cue caregivers progresses from reactive, gross motor movements that indicate general states of arousal and comfort to more intentional and refined small motor movements that communicate specific interests, needs, emotions, and thoughts (Fusaro & Vallotton, 2011). Communicative gestures are motor movements, done with hands or head, that communicate meaning (Vallotton, 2016). Young children's gestures can be organized into three broad categories: conventional, deictic, and representational or symbolic gestures. Conventional gestures are culturally specific and used in culturally shared social routines, like waving hello or goodbye, blowing a kiss, clapping for excitement or praise, or putting fingers to lips indicate quiet. These conventional gestures emerge early, around 8 months (Kwon et al., 2018), and vary from culture to culture in how common they are and when they develop (Kwon et al., 2018). Deictic gestures that can communicate within the immediate context to direct another's attention to a shared referent, including an absent referent, and to regulate another's behavior by making a request; reaching to indicate an object emerges around 7.5 months on average, while pointing emerges around 10.5 months (Crais et al., 2004). However, there is some evidence that this varies culturally as well, with those in Taiwan, where adult child interactions are more proximal, reaching, showing, and pointing later than those in the United States and Germany, which engage in more distal-style caregiver–child interactions (Kwon et al., 2018). Representational gestures are those that can communicate the same referent idea even when decontextualized from the original context in which they developed or were first used (Crais et al., 2004; Vallotton, 2016). Children spontaneously produce these gestures often starting around 12 months of age as they begin to refer to referents beyond the here and now (Bates et al., 1975), though children whose caregivers use them frequently and consistently from an earlier age will begin to use them earlier (Vallotton, 2010b). In the first half of their second year, children increase their use of representational or symbolic gestures until they have the words to replace them (Konishi et al., 2018). Infants will use symbolic gestures earlier and more often if caregivers model them intentionally and use them consistently (Vallotton, 2012). Children will continue to use both deictic and conventional gestures into and through adulthood, as these are integrated fluidly to supplement or emphasize verbal communication, while most use of symbolic gestures will be replaced with words and only retained when necessary to supplement or emphasize language (Goldin-Meadow, 2005). Infants' rapidly growing motor control, from head to body (cephalocaudal), from midline outward (proximal-distal), and from large muscle groups to smaller ones enable or limit infants' abilities to use their hands for communication within the first year of life. But what drives infants' development of these various types of gestures are their growing intentionality to direct their own behavior (Crais et al., 2004), their developing awareness of and interest in connecting and conversing with social partners (Tomasello, 2008), and their expending cognitive skills as they gain object permanence and interest in thinking and communicating about things beyond the here and now (Acredolo & Goodwyn, 1988). As they develop intentionality, they direct communicative cues toward others in order to regulate behavior (protest or request), initiate an interaction or participate in a social routine, direct other's attention, and eventually answer another's

questions or requests (Crais et al., 2004; Fusaro & Vallotton, 2011). By 12 months, infants can use pointing to share their attention and interests with caregivers, and vary their multimodal vocal and gestural cues based on whether their communication partner is attending. As their interests in and intentions toward the world expand beyond the here and now, and their desire to connect with others lead them to share these interests, infants move from conventional and deictic gestures into symbolic ones, and they use these symbolic gestures for a variety of communicative functions consistent with their growing intentionality and self-direction (Vallotton, 2008a), including the use of gestures to hold multi-turn conversations with caregivers about particular things or events in which infants are interested (Vallotton, 2010a). Studies of gesture use in children who are born blind and those who are born deaf reveal the universality and usefulness of gestures as both mental tools (for the speaker) and modes of communication (for the listener). Even in older children and adults, gestures are tools both for thought and for communication (Goldin-Meadow, 2005), but for young children they are ways to connect and converse with caregivers before they have words, and to engage in the kinds of conversations that facilitate language learning (Acredolo et al., 2002)

Impact of Infant Gestures on Caregivers Infants' gestures are communication cues that sighted caregivers can see, interpret, and use to gain insight into infants' mood and arousal states first, and later their mental states, including attention, interest, thoughts, emotions, and even memories (Vallotton, 2011; Acredolo & Goodwyn study on episodic memory). Infants' gesture direct caregivers' attention to their own interests, and draw out responses that meet their needs (Vallotton, 2012) and facilitate their learning (Goldin-Meadow, 2007).

Caregivers' and children's gestures are part of communicative behavior sets that are mutually reinforcing. Infants' initially learn gestures from adults' modeling, which is often unintentional, and can be experimentally induced (Choi & Rowe, 2021; Vallotton, 2012). But once infants begin gesturing, adults respond with more gestures as well as words (LeBarton et al., 2015). There are correlations between infant and caregiver gesture use (Rowe et al., 2008); and experimental studies have shown that infant's gestures can be increased by increasing caregivers' gestures but also that caregivers' can be induced to gesture and talk more by teaching infants to gesture (LeBarton et al., 2015).

Adults become more sensitive and responsive when infants gesture, including both parents (Vallotton, 2012) and child care providers (Vallotton, 2009). Mothers, fathers, and childcare providers feel that they understand infants' needs and intentions better when infants use symbolic gestures (Vallotton, 2011), which may be particularly helpful for those that are not the infants' primary caregivers (Vallotton et al., 2014). In a study of 10 infants and their caregivers in a child care setting observed over 8 months, when infants' used gestures specifically to respond to caregivers' gestures, that is when the infants were acting as communication partners, caregivers' interaction behaviors were more sensitive overall (Vallotton, 2009). Further, in an experimental study, parents in an intervention condition in which they were taught to use symbolic gestures were more responsive to their children's distress cues than those in the control condition, even if their infants used few gestures; but those whose infants used many different gestures were far more responsive to children's distress cues (Vallotton, 2012). Thus, even the expectation that children will gesture may attune caregivers to watch infants' behaviors closely, enabling them to respond more promptly and sensitively; and infants' actual gesturing draws out these responses to be even more sensitively contingent.

Just as with speech, more caregiver gestures is not always better for supporting infants' gesture use. When caregivers overwhelm a child with too many gestures, infants use fewer gestures (Vallotton et al., 2017a). Importantly, when caregivers are engaging with infants in more sensitive ways, they use their interaction history with infants to shape their own use of gestures. In an observational study of 10 infants and their caregivers over time, caregiver sensitivity moderated

the caregivers' use of pointing and symbolic gestures, such that caregivers increased or decreased their own use of these different types of gestures based on the infants' use of gestures in their last several interactions (Vallotton et al., 2017a). Thus, infants' gestures can either increase or decrease adults' gesturing type and frequency in order to draw out the type of communication behavior that will support their development, but only when adults are being more *developmentally sensitive* within the interaction.

Beyond the general increase in responsiveness, caregivers' typically respond to children's gestures with language in specific ways that help children pair words with the referents of their gestures, and enhances language learning (LeBarton et al., 2015; Rowe et al., 2008). Caregivers "translate" their children's gestures into speech, which puts words to children's thoughts and actions (Goldin-Meadow et al., 2007). When children use gestures to emphasize their words (e.g., using a bouncing motion and saying "ball"), caregivers often provide simple labels to confirm what children communicate (e.g., "Yah, the ball."). But when children use two different gestures together (pointing to a bird then flapping arms like wings), or use gestures to complement their use of words (e.g., pointing to a toy and saying "mine"), caregivers elaborate on what children communicate (e.g., "You see the bird flying outside," or "Yes, that bear is yours."). Toddlers' gestural vocabulary (number of different concepts communicated by gestures) predicts their spoken vocabulary, and their gesture combinations (e.g., using gestures to form sentences) predicts their sentence length 2 years later (Rowe & Goldin-Meadow, 2009).

Impacts of Early Conversations on Developmental Processes by Domain

We have now demonstrated that caregivers vary the content of their responses in response to the vocal qualities and directedness of the infant's vocalization and forms of gestures, further establishing the reciprocal impacts of conversation. To illustrate the iterative nature and ultimate impacts of these social feedback loops, summarized in Table 5.1, we consider how caregivers' conversational responses facilitate infant learning beyond infant vocal and gestural advances to create emotional connection, organize infant attention, and scaffold language development.

Conversations Provide Emotional Connection and Regulation

Infants and caregivers engage in face-to-face affective conversations, in which they imitate each others' multimodal cues, including vocalizations, facial expressions, eye contact, and gesture. In many cultures, both male and female caregivers' speech to infants (infant-directed speech) differs from speech to adults in that it is slower, contains longer pauses, simplified sentence structure, and has higher and more exaggerated pitch contours (Kuhl, 2007). As reviewed by Hennessy and Zhao (2023), both mothers' and fathers' infant-directed speech, as well as song, conveys emotional content and provides emotional connection that can both arouse and soothe. When they are attuned, these affective conversations cycle through clear patterns of emotion in which the infants' arousal and both parents' and infants' positive affect are increased until they reach a point where the infant is nearing overarousal and negative emotion. When caregivers are attuned, they will notice the infants' arousal state and decrease their own production of communication cues to help the infant reduce their arousal and bring their emotional state closer to neutral. An attuned dyad will often reconnect emotionally after this brief break in stimulation, through eye contact, touch, and shared affect, and the cycle may start again. In these affectively dynamic cycles of dyadic joint attention, infants experience emotional connection and regulation with their caregiver (Stern, 2018).

At least one study has shown that while mothers use infant-directed speech in similar ways across developmental time, fathers change their rate of infant-directed speech in response to their infants' development in ways that were supportive of later language (Shapiro et al., 2021). Although mothers and fathers across cultures use infant-directed speech in similar ways (as reviewed by Ferjan Ramírez, 2022), male and

female caregivers tend to stimulate and regulate infants' arousal and affect differently. Mother–infant dyads mostly cycle between low and medium levels of positive affect with highly positive arousal states coming on more gradually; whereas father–infant dyads cycle more rapidly into and out of high positive arousal. The affective synchrony infants experience with caregivers within the first year of life has been linked to later symbolic development, including verbal IQ, symbolic play, and use of internal state words. That is, through these early multimodal conversations, infants experience emotional connection, learn to regulate their arousal and affective states, and eventually gain the symbolic competence to label those affective states using words.

When older infants and young toddlers can use gestures to communicate their needs, label their own emotions, or indicate why they feel what they do or what might make them feel better (Vallotton, 2008b), they can take an active role in the regulation of their emotion (Vallotton, 2008a). Caregivers' responses in these moments of emotional communication support young children's regulation attempts and help them to build regulation strategies (Konishi et al., 2018). Children's reasoning about emotions is a much later emerging skill, but it is built upon the earliest foundations of caregivers' responses to infants' first communicative exchanges through affective expressions, and subsequent developmental sensitivity to infants' rapidly shifting communication cues.

Conversations Organize Infant Attention

Developmentally sensitive speech in response to infant behaviors organizes (Masek et al., 2021) and enhances infant attention in real time (Schroer & Yu, 2022). Parental speech can organize attention to the right place at the right time to help infants orient faster and extend sustained attention bouts. When infants are engaged in sustained attention bouts (at least 3 seconds of focused attention), they manipulate objects, developing their hand-eye coordination while also learning about object properties. Parents label and discuss objects to extend bouts of joint attention that predict vocabulary size. Caregivers also synchronize their speech with movement during bouts of joint attention, creating intersensory redundancy. This motion-speech synchrony creates structure between speech and action, increasing the target object's saliency. Aligning all of these caregiver behaviors (talking, holding, moving, and gazing) extends infant attention beyond the effects of gaze alone. Further, adults' pointing and gaze combinations orient infants' attention to objects both within and outside of their initial visual range, expanding infants' attention beyond what is immediately visible. And adults' gesture + word combinations effectively direct infants' attention during word-learning opportunities resulting in greater vocabulary. However, the content of the speech that accompanies these periods of joint attention differentially impacts attention. Caregivers' relative proportion of attuned (i.e., aligned with the focus of infants' attention) versus redirective responses predict infant attentional patterns. Five-month-old infants of highly redirective parents shift their gaze more frequently than those of highly attuned parents. By 1 year, redirective responses from caregivers cause infants to shift their attention more frequently, sustain their attention for shorter bouts, and decrease their caregiver-directed vocalizations. Thus, one pathway to supporting infant language development through parental responsiveness is through modulations in infant multimodal attention (Schroer & Yu, 2022).

Conversations Promote Language Development

Caregivers' responses to infant vocalizations are organized in predictable ways, allowing infants to detect and evaluate patterns. Importantly, caregivers simplify their speech in response to infant vocalizations (Albert et al., 2023). Compared to their speech at other times, responses to vocalizations are shorter, more likely to contain just a single word, and use a reduced number of vocab-

ulary words. Consider a parent's non-contingent statement that contains 13 words, such as "Should we get the ball so we have something new to play with?" compared to their four-word response of "You have a ball" following an infant babbling at a ball.

The simplification of speech in response to the babble likely facilitates language development at the statistical, semantic, and syntactic levels. First, when caregivers simplify their speech, they highlight the distributional patterns of their language. Shorter utterances contain fewer phonemes and word boundaries, allowing infants to track the statistical properties of their language. In this case, an infant can learn that the phonemes [b], [ə], and [l] are more likely to occur together than [ə] and [b], helping them to conclude that "ball" must be a word. Second, at the semantic level, hearing nouns in these simplified sentence frames facilitates word recognition. Pairing the label with a visual cue, such as the infant's own gaze toward the ball, or an adults' point toward the ball, simplifies the learning space and facilitates word-object mapping. Finally, at the syntactic level, simplified examples of speech highlight the grammatical structures of language. Here, "You have a ball" illustrates the standard subject-verb-object ordering of English without extraneous words to complicate infant parsing. Simplifying responses to infant vocalizations reduces the complexity of the infant's environment and highlights the structural regularities in caregiver behavior, facilitating language learning. As infants develop, parents are incredibly attuned to infants' understanding level and implicitly recognize when to simplify and scaffold learning and when to provide more complex speech. For example, parents will simplify and shorten their speech when they label an unknown object before expanding again to discuss known referents, which continues to promote receptive vocabulary and infants' conceptual understanding of the world.

When infants point to an object, caregivers typically translate this simple gesture into simple speech by labeling the referent object, "Yes, that's a bird." But when infants have a number of symbolic gestures for different referents and use a symbolic gesture to refer to an object or action, caregivers engage with infants in a substantive back-and-forth exchange (Vallotton, 2010a; e.g., Infant: Gestures "Bird" then points out the window; Caregiver: "You see the bird outside"; Infant: Gestures "Bird, tree"; Caregiver: "The bird landed in the tree. Now we can't see it anymore"; Infant: Gestures "Where"; Caregiver: "I don't know where it went. I can't see it either."). Thus, infants advanced use of gestures elicits well-timed and elaborated caregiver speech within the context of conversational exchange with triadic joint attention in ways that expand children's vocabulary and grammar (Rowe & Goldin-Meadow, 2009).

Observational studies have shown that parents' own gesture use itself does not predict infants' vocabulary development, but it does predict infants' gesture use, which draws out parents' verbal labeling, which supports children's word-learning and predicts later vocabulary (Rowe et al., 2008). In an experimental study in which infant communication bids were elicited, mothers' responses to infants' gestural communication cues predicted infants' concurrent vocabulary and later word-learning, but mothers' responses to non-gestural cues did not. Mothers' responsive labeling of objects and actions help to explain the links between infants' gestures and their spoken vocabularies. Thus, caregivers' gestures invite infants to gesture as a way to communicate their interests and direct caregivers' attention, which allows infants to draw out the verbal feedback they need in order to learn language.

A systematic review of the research on father–child play shows the developmental benefits of a more directive style of play interaction (Vallotton et al., 2020). Dads are more demanding playmates of their young children than are mothers; they take more initiative in play and ask their children to respond, whereas mothers more often respond to the child's initiatives. Fathers' more demanding style elicits more symbolic behavior and speech from children, which then creates more opportunities to respond and support children's language development. The developmental benefits of greater directiveness may seem

contrary to the dominant idea of sensitivity presented in the child development literature. However, these caregiver interaction behaviors are still prompt, aligned with infants' attention (though they may be directing infants' attention), and informed by an interaction history with infants' shifting cues and needs. Thus, the important contrasts in the literature between mother– and father–child interaction behaviors, and their unique contributions to infant language development, underscore the need to take a broader and longer view in defining developmental sensitivity.

Why Does It Matter?

All of this amazing learning through early conversations is building infant brains. From birth to 3 years, infants' brains are doing incredible work making connections and laying the foundations that will assist their learning and development of their entire lives. At the neural level, infant-initiated conversational turns are associated with white matter growth in areas related to prediction and expressive language development. So, caregivers' responsiveness models the 'serve and return' qualities of conversations and helps infants develop expectations that their behaviors generate social interactions. Dyads that engage in more conversational turns show greater neural synchrony, and the number of parent–infant turns at 6 months predicts white matter myelination at 2 years. Interventions to increase conversational turns suggest a causal link between responsive turn-taking and brain development. Thus, developmentally sensitive conversations support neuroplasticity, facilitating the development of attention, memory, language, and socio-emotional processing.

Caregivers who respond more contingently, and generate more conversational turns have infants with higher vocabularies (Tamis LeMonda et al., 2001). Responsiveness to gestures predicts vocabulary to 18 months across cultural and language groups (Cameron-Faulkner et al., 2021). Responsiveness to children's bids and vocalizations predicts achievement of language milestones in the transition to spoken language, such as first words, first 50 words, and first combinatorial speech (Tamis LeMonda et al., 2001). And responsiveness to gaze-coordinated vocalizations predicts expressive vocabulary up until 24 months (Donnellan et al., 2020). Further, conversational turns predict vocabulary development and language comprehension. The number of conversational turns parents have with children aged 18–24 months is a stronger predictor of verbal comprehension and vocabulary 10 years later than the total number of words spoken, even after controlling for socioeconomic status (Gilkerson et al., 2018).

Tamis LeMonda et al. (2019) assessed maternal responsiveness in early childhood in a way consistent with the idea of developmental sensitivity, combining particular types of responsiveness that change to response to children's growing needs (e.g., verbal responses to child vocalizations and object labeling at age 1 and 2; use of clear and complex speech, and acknowledging child speech at age 3; and use of longer words, complex sentence structure, and encouraging children to talk at 4.5 years). These developmentally sensitive interactions were part of a composite measure of the early learning environment that predicted children's academic outcomes to 5th grade; and these longitudinal associations were mediated through children's academic language skills at 4.5 years, including vocabulary and letter-word identification; findings were consistent across racial-ethnic and language groups in the United States. Thus, developmentally sensitive parent–child conversations predict the pre-kindergarten language skills that enable children's academic success through elementary school.

These findings reiterate the importance of developmental sensitivity in caregivers' interactions over and above the frequency of interactions. These responses cascade over time to predict developmental milestones such as emerging literacy, school readiness, and adolescent cognitive processing (Gilkerson et al., 2018). Beyond cognitive development, early conversations are also predictive of children's socioemotional capabilities in toddlerhood. Higher conversational

engagement at 18 and 30 months is predictive of emotional regulation skills and secure attachments at 7 years. In summary, infants' early conversations are the starting point for creating social relationships that help babies figure out the world and lay the foundation for becoming skilled communicators and lifelong learners.

Variability in Children's Cues and Context

In addition to the rapid vocal and gestural advances described earlier in this chapter, and variation across cultures in the goals, proximity, function, and content of communication within caregiver–child interactions described earlier, developmentally sensitive conversations are also shaped by layers of individual differences within the dyad, and variability across the physical and social environment. Returning to Fig. 5.1, if we imagine additional children in any of these circles of interaction, then the conversations around them immediately become more complex. At any time, the caregiver could be responding to an infant who just initiated a conversational turn or providing overheard speech as they react to other children nearby. Further, if we imagine that those infants in Fig. 5.1 vary, not only in their age and developmental stage, but also in temperament, sex, and a range of neurological characteristics, we see how very differently these interactions may look and sound, and how these differences may shape development.

Individual Differences Among Infants and Caregivers

Infants exhibit various individual differences in engagement, attention, and interest in social interactions. There is a large range of normative behaviors among typically developing infants regarding the frequency of gestures and vocal production. Some babies are more or less chatty. Some infants are more interested in engaging with people, while others focus on object interactions. Similarly, individual differences among caregivers also impact conversations. Both personality differences and situational context might shift caregivers' patterns of engagement at any particular time. Sometimes, caregivers are focused and engaged, looking for every opportunity to capture their infant's attention and start a conversation. At other times, they may be multitasking, reflecting on their mental to-do list while passively attending to their infant's activities. Caregivers who are more selective when responding may be more effective at scaffolding infant attention by engaging in moments that help infants sustain their attention for longer (Schroer & Yu, 2022). Increased selectivity may also make caregiver responses more salient when they occur and, therefore, more potent for learning. Conversations also shift as infants become more mobile because new postures bring new opportunities to engage and elicit language from caregivers. Mobile infants expand the conversational space to more places and objects including absent referents.

Infants with developmental disorders or sensory impairments exhibit additional variability in when they reach communicative milestones beyond the range of typically developing infants. For example, infants with hearing impairment, Down syndrome, and those at higher risk for diagnosis of autism spectrum disorders (ASD) demonstrate different patterns of vocalizations and often show delays in producing canonical babbling. Infants with later ASD diagnoses also use fewer gestures, but parents are similarly responsive to children's gestures for those who are typically developing and those who will later be diagnosed with ASD (Choi & Rowe 2021). Conversely, children with Down syndrome produce more gestures than typically developing peers, but after controlling for expressive language, rates are similar; that is, children with Down syndrome use gestures for a longer period to supplement their language learning. Mothers of children with Down syndrome continue to translate their children's gestures into words at similar rates as their children age. Thus, the individual characteristics of infants that shape their communication behaviors will draw out variations in caregiver responses in ways that can sup-

port language, although these are moderated by cultural beliefs about ways to promote children's language.

Variability Across Contexts

The immediate context, or local environment, in which conversations occur also shapes the content and opportunities for infants to learn from conversations. At home, caregivers develop a rich interpersonal interaction history with their infants, building on activities in familiar locations and establishing routines and expectations around meal times, personal care, and play. Infants create common ground from regular interactions with familiar people and objects, and interaction patterns shift as conversations expand to include siblings and other adults nearby. These rich interactions extend to novel spaces outside the home, but caregivers and infants adapt their play and responses when in less familiar environments. Infant gestures and vocal cues inform parents when a situation requires more explanation, and parents seamlessly adapt their language to simplify speech to label and discuss unknown objects. In addition to parent–infant infant interactions, babies worldwide are frequently cared for by non-parental caregivers such as relatives, babysitters or nannies, and educators in childcare settings. The group dynamics of childcare classrooms inevitably alter conversations. For example, infants will hear more overheard speech as the number of children near a caregiver increases. Classroom activities such as meal times, playtime, book sharing, and personal care routines also create different opportunities for relational language, vocabulary building, and interactions. In childcare contexts, there are more demands on caregivers' attention and additional context cues for adults to react to when they are responsible for multiple children of various ages with varying developmental needs. Further, non-parental caregivers working in group care settings have less developmental history with each infant, and care for several infants at a time, each of whom are rapidly shifting in through subtle phases of communication skills. Unlike parents, infant teachers do not modify the rate or content of their responses based on the maturity of infants' vocalizations (Albert, 2021); thus, the context of their work with infants may make them less developmentally sensitive to shifts in infants' vocal maturity. However, when they can focus their attention and respond sensitively in the moment, infant teachers can take into account their recent interactional history with an infant to modify their own communication behaviors in ways that support infants' communication (Vallotton et al., 2017a). Thus, even though infant teachers in group care contexts must split their attention to respond to multiple rapidly changing infants with whom they share less developmental history, they can still respond in developmentally sensitive ways.

Suggestions for Parents and Practitioners

So far, we have demonstrated that infant behaviors such as vocalizations and gestures are powerful cues for organizing caregiver attention to elicit conversations that shape infants' language development through numerous mechanisms. We have also shown that parents intuitively and implicitly track their infant's capabilities to respond appropriately without explicit training (Papousek & Papousek, 2002). Despite often feeling like they are inexpert in understanding their own children, parents are intuitive geniuses at reading and responding to these subtle cues in ways that advance development.

However, the variability in children's learning outcomes suggests room to enhance language development support by working with families or educators for whom it is a priority. The guidance provided to parents, practitioners, and early childhood educators is often vague, making broad appeals to simply talk more, or providing strategies to verbally regulate infant behavior, with less emphasis on specific ways to promote language development. Many parenting and teacher education programs stress sensitive responding to infant behavior, but there is less emphasis on responding contingently to engage

in true back-and-forth conversations with babies. Thus, we conclude this chapter with concrete suggestions that can be used to help families or educators engage infants in conversations to promote learning.

Selective Silence: Shut Up and Watch

Perhaps counterintuitive, our first recommendation is to watch and listen. When a caregiver's culture emphasizes the value of language, caregivers are often urged to provide a steady stream of chatter to expose their children to as much speech as possible. Parents who speak nonstop are more likely to inadvertently redirect their child's attention or disrupt moments of focused play. Continuous chatter is also exhausting for both caregivers and infants! Just like adults, babies need downtime and space to explore. In Western home environments, 20–30% of an infant's active day contains no speech. These auditory breaks are helpful as they give infants time to process recent experiences and play independently. In many non-Western cultures, speech directed to infants is less frequent, and independent play is the norm. Observing infant activity and looking for moments to establish meaningful conversations around their interests can authentically jumpstart conversations when infants are receptive to engaging. Recognizing that infants are active conversation partners shifts the focus from talking to fill the auditory space toward recognizing when infants are trying to engage caregivers in conversation through joint attention, gestures, and babbling.

Model Multimodal Communication to Promote Bidirectional Conversations

Caregivers must remember that much of communication is nonverbal and multimodal; that is, infants intentionally communicate with their faces, hands, eyes, and mouths. Watching and listening to what infants are attending to, feeling, and attempting to do will give caregivers lots of relevant things to talk with infants about. When caregivers communicate with their hands as well as their words, they provide infants with examples of multiple communication modes that infants can learn to use prior to speech, giving infants more tools to participate in conversations with caregivers and elicit the responses that will help them learn language.

Intentionally Sensitive Responses: Talk Smarter, Not Harder

Once caregivers focus on creating conversations, other adaptive behaviors that support learning emerge. As previously discussed, the moments following an infant's communicative acts are prime opportunities for infant learning because infants are more receptive to learning and because caregivers align their responses in ways that facilitate learning. First, caregivers tuned in to their infant's babbling *simplify their speech* when responding contingently. Simplified responses to babbling are shorter, less grammatically complex, and contain targeted vocabulary, which provides language examples when infants are primed for learning.

Second, caregivers look for opportunities to play, discuss, and label objects that match the infant's visual attention and gestures. Following the infant's lead *establishes joint attention* and increases the likelihood of providing an aligned response that matches the focus on the infant's engagement. For example, when 9-month-olds babble at nearby objects, caregivers often respond by expanding the babble into a word. Responses that match the infant's focus of attention can enhance vocabulary building. However, redirective responses, such as labeling an object the infant is not attending to, negatively impact later vocabulary (Tomasello & Farrar, 1986). Providing labels that align with what the baby is looking at rather than what their babble sounded like helps them build word-object associations and is associated with comprehensive vocabulary at 18 months.

Caregivers in tune with their infant's capabilities recognize infant speech qualities and respond more frequently to babbles that sound closer to words. Parents will *scaffold their infant's vocal development* by responding most frequently to the infant's more speech-like sounds. For example, vocalizations with consonants (e.g., [ba] or [da]) are more advanced than vocalizations only containing vowels, particularly ones that sound fussy or nasal. Over subsequent interactions, caregivers respond selectively to more complex behaviors, effectively signaling the value of communication and shaping infants to more advanced behaviors.

Once infants have a range of words or symbolic gestures and begin to use them in combination, caregivers can *expand on infants' advanced communication cues* in ways that elicit further communication with infants and keep the conversation going. Infants' own combinations of words or gestures + words that form multimodal sentences are cues that they are ready to hear and learn more elaborate speech. When caregivers respond to these advanced cues with longer sentences it supports children's grammatical development.

Summary and Key Points

Developmentally sensitive responses require caregivers to attend to the relative sophistication of infants' communication cues, which indicates their developmental readiness for different types of caregiver input. The subtlety of the changes in infants' cues, along with the everyday complexity of caregivers' lives, embedded either in home or early education contexts, makes a concept like developmental sensitivity seem infinitely challenging, and shows the intuitive genius of caregivers who support their children's language development through authentic and loving everyday interactions, making it look so natural and so simple.

Key Points

- Infants are active contributors to conversations, initiating and extending conversations through their gestures and vocalizations.
- Caregivers' developmentally sensitive contributions to conversations are a product of both the infant's actions in the immediate context, the dyad's shared recent interaction history, and the cultural norms that inform the caregivers' parenting practices.
- Individual differences and variability in each of these components adds richness and complexity to the interaction space.
- Multiple caregivers (mothers, fathers, and non-parental caregivers) support infants' language learning, and may be differentially sensitive to infants' cues, and respond in complementary ways that collectively promote optimal language development.
- Encouraging caregivers to notice and respond in developmentally sensitive ways—including through selective silence, multimodal engagement, and language simplification in the word-learning phase—can enhance language learning opportunities for infants.

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6 Mental Health in Toddlerhood: The Dynamic Balance of Anxiety, Autonomy, and Attachment

Alicia F. Lieberman and Rachel C. Tomlinson

Toddlerhood is usually understood as the developmental stage between 1 and 3 years of age when the young child acquires and consolidates autonomous upright mobility, as defined by the ability to walk, climb, run, jump, leap, hop, and skip. The simple act of listing these different components of locomotion evokes a sense of wonder about the enormously expanded physical world that the infant encounters in the transition to toddlerhood. From being a "babe in arms" held and contained by the adult's arms, the toddler now experiences a growing sense of autonomy, quickly moving from crawling to standing and to independent steps that become increasingly faster, more self-assured, and often beyond immediate adult control. This new locomotor agency is synergistic with emotional agency. Toddlers become increasingly self-directed in going where they want to go, doing what they want to do, and protesting strongly when people and objects do not conform to their expectations.

Along with the new mobility there are rapid advances in language acquisition, symbolization, and self-concept, which are associated with greater mastery of executive function, problem-solving, affect regulation, and interest in the motivations and feelings of others. Toddlers' increasingly differentiated sense of self includes multiple facets: Self-recognition; awareness of their subjective experience and use of words to communicate wishes and feelings (*gimme; mine; pick up; put down; no; sad, mad, happy*); exploration of the body and its functions, including play with the genitals; interest in sex differences; the emergence of complex self-conscious emotions such as envy, jealousy, shame, guilt, embarrassment, and pride as well as aggressive behavior and intentional hurting. This growing sense of self and self-assertion evolves in tandem with a growing interest in the self of others. Toddlers become increasingly attentive to the emotions, wishes, and intentions of people who are important to them and take these mental states into account to guide their own behavior – a set of capacities known as "theory of mind" (Kagan, 1981; Premack & Woodruff, 1978; Roiphe & Galenson, 1981; Tremblay et al., 2004).

As these skills emerge and consolidate, toddlers experience considerable challenges to their capacity for self-regulation, resulting in the emotional outbursts ("tantrums") characteristic of this age. Emotional regulation challenges stem primarily from four sources: (1) Uncomfortable body sensations such as hunger, problems with digestion and elimination, aches and pains, illness, and injury; (2) Gaps between what the toddler wants to accomplish and the child's physical limitations (e.g., striving to retrieve a desired

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object that is out of reach); (3) Discrepancies between the toddler's wishes and the behavior of others (e.g., another child taking the toy the toddler was playing with; a caregiver stopping the child's play because it is bedtime); and (4) Socialization practices calling for the child's effortful learning of new standards and restriction of spontaneous impulses, such as toilet training and inhibition of aggressive behavior.

While practicing mastery of the body and the environment, the toddler faces a world filled with uncertainty where danger lurks unpredictably. In this sense, toddlerhood involves the first encounter with consciously felt helplessness—i.e., the experience of a fundamental misalignment between personal desires and a world that functions independently of those desires. The child's body might not respond as expected, resulting in falls and other accidents with consequences for body integrity that range from mild to severe. Objects do not always operate according to the child's expectations: lit candles are enticingly shiny but produce a painful burn when touched. Adults and other children in the toddler's social orbit may be unavailable, unresponsive, demanding, threatening, or punitive.

Helplessness need not generate loss of agency. Infants are biologically equipped to seek protection by maintaining proximity and contact with a protective adult in response to real or perceived threat. The attachment motivational/behavioral system emerged in the context of evolution to provide protection and promote survival and reproductive success (Bowlby, 1969, 1982). The toddler's growing sense of autonomy—beautifully articulated in the toddler motto, "Me do it"—must find an accommodation with the child's equally compelling need for adult help to survive and thrive in a dangerous world. Mental health at this age revolves around the question of how the toddler navigates the conundrum between autonomy versus attachment and between socialization versus self-assertion in the context of family expectations, cultural values, and social protective and risk factors.

The toddler negotiates these challenges while engaging in the self-referential thinking that predominates during the sensorimotor and preoperational stages of cognition and co-exists with the theory of mind capacities that unfold at this age. Toddlers attribute causal power to their own thoughts and wishes and harbor the conviction that they are the reason that things happen in their lives – whether good or bad. Lifelong pathogenic beliefs in one's guilt for being abused, for example, can be traced back to this subjective understanding of causality, only too often reinforced by the blame of adults that the child's behavior "made it happen". Helping toddlers understand how reality operates and helping to relieve them of the emotional burden posed by their exaggerated belief in their power to make things happen are crucial components of sound parenting and effective therapeutic intervention in the toddler years.

The section below provides an overview of the dynamic interplay between fear, attachment, and exploration as core motivations that shape toddlers' inner life and provide the template for their emotional and social relationships. Cultural patterns of childrearing and social and family mores may alter the specific manifestations of this interplay. For example, children reared in communal environments with multiple caregivers may show less fear and adapt to the temporary absence of a specific attachment figure more easily than children reared in societies where nuclear families are the norm. For same sex parents, traditionally gendered parental roles may manifest differently than in families with a mother and a father. Human diversity is pervasive and toddler development must always take cultural, social, and individual contextual factors into account.

The Protective Motivational Triad of Fear, Attachment, and Exploration

Evolution has equipped humans with a triad of core motivations—fear, attachment, and exploration—that operate in tandem to increase the vulnerable young child's chances of survival and adaptive functioning. *Fear* instills wariness of unfamiliar people and situations and unpredictable or unusually intense stimuli. *Early attach-*

ments promote proximity and closeness to one or a few protective adults who are deeply invested in the child's protection and well-being and to whom the child turns instinctively in situations the child cannot master on her own. *Exploration* entices the child to move beyond the immediate physical sphere of the attachment figure(s) to discover, practice, and consolidate knowledge and skills.

Fear and Normative Anxieties

Fear is a warning motivational/behavioral system that alerts to the presence of external danger to mobilize a fight, flight, or freeze response to restore immediate safety. Fear is triggered by input from any or all the five senses: seeing, hearing, touching, smelling, and tasting, and by unexpected kinetic experiences such as loss of balance. Bowlby (1973) argued that young children's fears of being alone, proximity to strangers, unfamiliar settings, darkness, looming objects, and loud noises emerged in evolution as an adaptive response to these "natural clues to danger", which are not intrinsically dangerous but increase the likelihood of being harmed. In close association with fear, anxiety is also an alerting system but it serves the function of protection from future danger – directing attention to the *possibility* of an event that will threaten safety and survival. Anxiety is triggered by *remembered fear*. It can become a pervasive inner state of anticipating danger even in externally safe situations, particularly when the outcome of previous experiences of fear has not been experienced as sufficiently protective.

Through experience and practice, humans learn about the environment from an early age, habituate over time to the reliable characteristics of their milieu and deploy their attention selectively to what is dangerous and what is not (Rankin et al., 2009). Toddlers' fledgling understanding of causality and immature capacity to anticipate future danger creates a confusing merging of fear and anxiety. They are increasingly able to imagine possible future consequences of present events but do not have an accurate appraisal of how safe or dangerous the future outcome will be. Watching the mother put her coat on, for example, signals for the child that she will be leaving. From the perspective of an infant or toddler, this is a clear and present danger because separation is equated with threat even if the child stays with someone who can provide objective protection. Fear and anxiety have both overlapping and also distinct physiological profiles and subjective sensations that often make them difficult to distinguish in everyday life.

Sigmund Freud understood that young children give meaning to events through the filter of threat versus safety and proposed a developmental sequence of *internal dangers* that he described as *fear of abandonment, fear of losing love, fear of castration,* and *fear of superego condemnation* (Freud, 1926). In the century that followed this penetrating insight, the classic psychoanalytic theory underpinning each of these constructs has largely evolved into a more relational and less conceptually rigid approach to psychic structure and the nature of psychic conflict. Considerable observational, clinical, and research data have also accumulated on infants' capacity to identify threats and respond self-protectively, pointing to the presence of fear as a core motivation from the beginning of life. Lieberman (1993/2018) reconceptualized these internal dangers to align them with more current developmental, clinical and research data on the normative fears of the first 5 years of life, as summarized below.

Fear of separation and loss Infants and toddlers are routinely distressed when separated from their attachment figures and show it through so-called *separation protest* in the form of crying, reaching towards, and clinging to the attachment figure. Fear of separation emerges when children are about 6–8 months old, intensifies between 12–18 months, and decreases gradually towards 24 months of age. Protesting separation is the young child's most powerful strategy to persuade the attachment figure not to leave. Toddlers use their newly acquired self-awareness and theory of mind in efforts to forestall this danger, for example, by screaming "don't go!" when their attachment figure is leaving.

The fear of separation is inextricably linked to fear of loss. Infants and toddlers have not yet mastered object permanence, resulting in uncertainty about the loved person's return or even continued existence while out of sight (Piaget, 1959). People—including children—enter different emotional states with different people and feel safest with one or at most a small number of relationships. Young children do not feel fully themselves in the absence of the loved one and must accommodate to surrogate people without a sturdy sense of object permanence as a conceptual anchor reassuring them that their preferred "way of being with another" will be re-established. Cole Porter evokes the lingering visceral impact of separation when he wrote, "Every time we say goodbye, I die a little; every time we say goodbye, I wonder why a little; why the Gods above me… think so little of me they allow you to go". For infants and toddlers, separations pose basic existential questions: "How do I retain the ongoing sense of myself in your absence? What does it say about me that you are going away? Will you come back?" These are life-long concerns that have special urgency in the first years of life.

Fear of losing love Freud posited that love and hunger are the two great human needs, classing them, respectively, under instincts for the preservation of the species and instincts for self-preservation. He attributed the young child's fear of losing love to the human species' social nature and dependence on others for individual and species survival. Although fear of losing love has not been widely investigated in developmental research, there are two sources of evidence suggesting that this is an explicit concern for 2- and 3-year-olds. One source of evidence is observational. Toddlers monitor the facial expressions and behavior of their attachment figures and respond with intense distress when their behavior causes parental disapproval. They also attribute to themselves the reason for their attachment figures' moods and behaviors ("Daddy left because I screamed"). Once they acquire language, they may ask "are you mad at me?" or say "you don't love me" in response to conflict with the parent. They also experiment with withdrawing their own love. "I don't like you!", "You are not my friend!", and (most ominously) "I hate you!" are typical toddler utterances that reflect the centrality of love and its vicissitudes as a central preoccupation of the toddler years. The second source of evidence is inferential and emerges from research on toddlers' distress to perceived failures to meet adult standards. In a series of classical longitudinal and cross-sectional experimental studies, Jerome Kagan (1981) documented the emergence of distress in the second year of life when the toddler does not meet perceived adult standards of what is proper performance, even when there is no explicit request for the child to do so. Kagan attributed the distress response to the dual influence of toddlers' newly acquired abilities to evaluate actions as good or bad based on adult modeling, expectations, and behavior and their simultaneous ability to self-assess whether they can meet these perceived adult standards. Observational data support this hypothesis. In a notable example from daily life, a 24-month-old boy burst into tears when he saw a potty that his parents had introduced in his bedroom the day after a conversation where they told him that he would soon learn to use the potty. The child had not seemed to grasp the significance of this conversation at the time and the parents did not explain to him why they put the potty in his room, but he made the implicit connection and was distraught by his anticipation of not being able to meet his parents' expectations. He relaxed visibly when his father told him that his potty was there to be friends with him and he could sit on it whenever he was ready. We can infer that this reassurance restored the child's trust that he had retained his father's love and approval.

Fear of body damage Freud's (1933/1965) assertion of the existence of castration fears in young children has always been controversial and is widely critiqued or dismissed. The continued relevance of the concept derives not from the now somewhat archaic Oedipus complex theory that Freud built around it but from the noteworthy frequency with which typically developing

toddlers of both sexes show their interest in the penis and express curiosity and worries about its presence or absence. One can take seriously a young boy's fear of losing his penis or a young girl's wish to have one without adopting Freudian specific views about the role of castration fears in psychic development. A middle ground between reifying or dismissing the fear of penis loss is to place this fear among other specific fears that toddlers show about body integrity, including distress when their hair or nails are cut, feces are flushed away, or they have a cut or bruise. Toddlers may have an oversized reaction to seemingly small scrapes, declaring for example "I need a band-aid!" after falling or bumping into an object even when no damage is visible. The adaptive function of fearing bodily damage is evidenced in the timing of its onset at about 12 months to coincide with the consolidation of autonomous locomotion, when the chances of getting hurt increase exponentially and when the fear of getting hurt serves as a powerful deterrent to self-endangerment.

Fear of being bad Students of child behavior have long observed young children's pleasure in adult approval and distress when adults disapprove of them and inferred the existence of a moral dimension that is intrinsic to human nature and emerges in childhood. Freud (1933/1965) coined the concept of superego as the personality component that monitors ethical standards internalized from parents and teachers. This arbiter of personal goodness is consolidated in the preschool years, when children have a more reliable understanding of good and bad social behavior. The research showing toddler distress about not meeting adult standards (Kagan, 1981) suggests the early origins of the ability to compare one's performance with the performance of others who are viewed as the model of who to be and how to behave. Toddlers may express this fear by hitting themselves, looking ashamed, hiding, or whispering "I am bad" when they make a mistake. Shame might have its origins in a fear of not being able to meet social expectations, first from attachment figures and in a gradually expanding circle from peers and other important adults until it becomes a generalized self-concept of deeply rooted insecurity about one's inherent worth.

Taken as a whole, these fears convey how deeply toddlers feel and how earnestly they endeavor to make sense of human relationships and their place in their social milieu. We can think of the toddler as a precocious existential philosopher grappling with the questions: "Can I trust you?", "Will I be left?", "Do I deserve love?", "Will I be hurt?", "Am I bad?" with the caveat that these questions are not rhetorical but originate in and are perpetuated by their immediate relevance to survival. Many of the seemingly irrational reactions and baffling symptoms of toddlers become meaningful and can be alleviated when they are understood as expressions of these core fears (Lieberman, 1993/2018). Minimizing, dismissing, or criticizing toddlers' intense emotions can generate an early and pervasive mistrust of feeling as a valuable compass for self-understanding and for reciprocity in relationships.

Attachment: The Protective Power of Love

There is extensive evidence that toddlers' fear is eased by the presence of the attachment figure, to the extent that even a photograph of the mother can serve to calm a young child's fear (Passman & Erck, 1977). Bowlby (1969, 1982) proposed that the attachment bond has the biological function of increasing a child's odds of survival by providing protection from danger through child behaviors that promote proximity and physical closeness to the attachment figure. The consistent availability of a protective adult—most often the biological mother in the first and second years of life—who identifies and retrieves the child from external dangers and who responds to the child's signals of need generates in the child an expectation of protection that is subjectively experienced as a feeling of security and well-being. Four decades of research provide impressive empirical evidence that the quality of attachment contributes

significantly to socioemotional competence and healthy functioning across the lifetime (see DeKlyen & Greenberg, 2008; Lyons-Ruth & Jacobvitz, 2008 for reviews). Securely attached infants and toddlers turn confidently to the attachment figure when feeling threatened, whereas young children who do not have an internalized expectation of protection resort to avoidant, resistant, or disorganized attachment strategies to cope with the experience of fear (see Weinfield et al., 2008 for a review).

Young children develop in the context of their primary relationships, and the caregiving system has emerged during evolution with the goal of providing protection to the child (George & Solomon, 2008). The attachment and caregiving systems operate synergistically. Quality of attachment is associated with the primary caregivers' responsiveness to the child's signals, so that infants whose mother figure responds in primarily consistently supportive and protective ways to the child's distress tend to develop secure mental representations of attachment, whereas infants whose attachment figures are as a rule unresponsive, inconsistent or frightening tend to develop anxious or disorganized mental representations of attachment (Ainsworth et al., 1978; Main & Hesse, 1990).

Toddlerhood presents new challenges for caregivers to maintain the consistent, supportive responsiveness associated with secure relationships in infancy. Raising toddlers is physically and emotionally demanding. Parents and caregivers must be on constant alert to keep the child safe, problem-solve frequent discrepancies between adult and child agendas and keep up with the toddler's high levels of physical energy, demands for engagement, and refusals to comply with parental directives. The recurrent mismatches between what the child and the parent want and need may help to explain why the first years of life are the most vulnerable. Almost three-quarters (70.3%) of child fatalities from maltreatment by a parent or caregiver involved children younger than 3 years in 2019 (US Department of Health and Human Services, 2021). These stark statistics convey an equally stark message: infancy and toddlerhood present developmental and emotional challenges for parents as well as for the young child, as parents must adjust their own developmental agendas and personal wishes to meet the needs of an often unpredictable and noncompliant child.

Bowlby (1969, 1982) described a goal-corrected partnership as the most mature phase of attachment, emerging towards the third year of life and involving negotiation of different child and parent agendas, collaboration, mutual adjustments, and the acceptance of regular conflicts between the child and the parent that are intractable in the moment and result in one partner imposing her will. The parents' role in modeling conflict repair to foster mature secure attachments cannot be overstated. Intense conflicts are inevitable in all love relationships across the lifetime because attunement to the other collapses when one's needs feel urgent and irreconcilable with the partner's needs. For toddlers, learning about repair is crucial for healthy personality formation because they are in the initial stages of internalizing patterns of relationships and creating life-long templates for resolving conflicts and tolerating ambivalence towards the people they love. Parents are the models for how repair can happen. The Circle of Security motto describes this aspiration well: "*Always*: Be Bigger, Stronger, Wiser and Kind; *Whenever Possible*: Follow My Child's Need; *Whenever necessary*: Take Charge." (Cooper et al., 2005). Another sage dictum is also pertinent in this context: "The best is the mortal enemy of the good" (Montesquieu, 1720/2012). Given human vulnerabilities, it is impossible to be always bigger, stronger, wiser, and kind without also being emotionally inauthentic. However, partners can always strive to recover and reconnect after an emotional rupture. If the child's physical and emotional safety is not jeopardized, secure attachments are built as much by deeply felt emotional exchanges (including anger) as by consistent attunement, provided conflicts are resolved or compartmentalized so that they do not suffuse the entire emotional tone of the relationship. It is fitting to close this section with Winnicott's reminder that sentimentality about mothering is not good for children because they can only learn

to tolerate their own complex mix of emotions about human relationships if their mothers can acknowledge, express, and contain the ambivalence inherent in mothering and in all other close human relationships (Winnicott, 1958). The same truth applies also to fathers. Only by embracing the full range of emotions and learning to modulate them together can child–parent relationships move from the realm of fantasy to genuine intimacy.

Exploration: Finding One's Way in the World

The exploratory motivational/behavioral system is fueled by the child's curiosity and eagerness to learn about the physical world and gain mastery of the surroundings. Studies of exploration in infancy and toddlerhood show that the presence of the attachment figure enhances the child's exploratory behavior, whereas her absence tends to decrease it. Quality of attachment also plays a role in the child's quality of exploration, with securely attached toddlers showing more competent exploration in the Minnesota longitudinal study than insecurely attached toddlers, who were less curious, less effective, and less enthusiastic in their efforts to master challenging tasks as well as less competent in enlisting their mothers' help (Arend et al., 1979; Matas et al., 1978). Similar associations between quality of attachment and quality of exploratory behavior in many subsequent studies in different countries led Grossman and colleagues to coin the concept of "security of exploration" as a companion to security of attachment, defining it as "confident, attentive, eager, and resourceful exploration of materials or tasks…accompanied by persistence and tolerance of frustration in the service of goal-corrected action" (Grossmann et al., 2008). Here the role of fathers as attachment figures emerges with great clarity. Numerous studies show that security of attachment to fathers is best predicted not by sensitive response to the child's signals of need as is the case with mothers but rather by the father's warm, supportive, and sensitive challenges to the child during joint play. The close empirical connections between security of attachment and security of exploration led in turn to the concept of "psychological security", which depends on both secure attachment and secure exploration with the mother and the father (Grossmann et al., 2008).

Secure Base Behavior: The Dynamic Balance of Fear, Attachment, and Exploration

Psychological security during toddlerhood is perhaps best illustrated by the toddler's ability to move organically from seeking proximity and contact with the caregiver to exploring away from her depending on the appraisal of environmental and internal dangers. The central attachment theory concept of "secure base from which to explore" was developed by Mary Ainsworth (1963) to describe the dynamic balance between attachment and exploratory behaviors, which shifts according to the child's experience of fear in response to external and internal stimuli. Exploration comes to a halt when the infant/toddler is frightened and comes close to the caregiver for protection. Conversely, attachment behaviors are curtailed when the child feels safe and ready to explore. In these conditions, the child may check in visually with the caregiver, show a toy from some distance away, or engage the caregiver episodically, but the primary focus of attention is on exploration and play rather than on proximity and closeness.

A rigorous observational study of toddler behavior in London parks suggests that young children have an internal compass for managing the balance between exploration and attachment behaviors. Anderson (1972) tape-recorded 15-minute descriptions of individual toddlers' behavior as they moved about in a London park, while the mother was seated on a bench or in the grass. The toddlers were free to determine on their own how far to go and stayed within about 200 feet from the mother. They also moved in "bouts" that either increased or decreased the distance from the mother but kept her at the center of their activities. When they were within 3 feet

of the mother, the toddler tended to play in place for longer; forays further away tended to be briefer. The mothers' behavior mirrored their children's appraisal of the appropriate balance between risk and safety. They tended to stay in place if the child remained within the 200 feet perimeter but called out or moved to retrieve the child if the distance was increased. It is noteworthy that the appearance of a potential threat such as a dog on the loose changed this calculus, so that the mother called out to the child to move closer and moved to act if the child did not comply. The toddlers themselves participated in this process through pointing at a distance. When the objects they pointed at were harmless, the mothers showed mild interest or ignored them but reacted promptly if they detected risk. An unpublished observational study of toddlers in a Mexican zocalo found similar patterns of toddler secure base behavior and maternal response (Lieberman, 1976).

Secure base behavior in the second and third years of life provides a unique lens for assessing how the child learns to become self-protective by internalizing the protection provided by attachment figures. Toddlers internalize relational patterns to create mental representations of the self and of relationships that become consolidated and contribute to emotional health or mental health disturbances. The behavioral secure base becomes an internal sense of security both in relationship with oneself and in relationship with others.

Distortions of secure base behavior, in contrast, are a powerful indicator of anxiety in the attachment relationship. Three patterns of secure base distortion were identified in a clinical population of toddlers and their mothers extensively observed at home and in a clinical playroom during treatment: recklessness, inhibition of exploration, and role reversal in protection (Lieberman & Pawl, 1988, 1990; Lieberman & Zeanah, 1995). Each of these patterns is described below.

Recklessness and accident proneness This pattern distorts the attachment-exploration balance by prioritizing exploration over attachment in unfamiliar and potentially risky situations. Toddlers who engage in consistently reckless exploration routinely run away from the attachment figure on the street, get lost in crowded situations by moving away without checking back, and do not show cautiousness when engaging in physical activities that may hurt them. What distinguishes reckless toddlers from unusually active and physically energetic children is the lack of attention to the mother's whereabouts and the chronicity of the self-endangering behavior, which persists across numerous unfamiliar settings. Some reckless toddlers also show aggressive behavior towards the mother and/or peers, but this is not a consistent finding. Close clinical observation reveals that these children show signs of anxiety that are often overlooked because their recklessness is the prevailing presenting problem. They may bite their nails to the quick, pull their hair, scratch themselves nervously, show sleeping difficulties, and experience intense separation distress that is quickly followed by darting away. The co-occurrence of recklessness and anxiety symptoms gives the impression of a counterphobic response to fear of separation and loss. The toddler seems to be asking their mothers: "Do you keep me in mind? Will you look for me and bring me back? Will you keep me safe?"

Inhibition of exploration to maximize felt safety Toddlers showing this type of secure base distortion stay close to the attachment figure even in familiar situations where carefree exploration is expected because of the objective safety of the environment. This pattern differs from expectable wariness in response to novelty because of its persistence after the child becomes familiar with a new situation. Exploration has a subdued quality and lacks the exuberance characteristic of this age. These toddlers' behavior seems to indicate lack of certainty about the caregiver's protective availability. They seem to be saying, "I cannot risk moving away from you because I cannot be sure that I will find you when I need you". Indeed, the defensive function of the inhibition of exploration becomes apparent when the toddler is coaxed into moving away from the attachment figure and may become motorically disorganized

and engage in flailing and screaming. Exploration itself triggers fear, and its inhibition suggests a phobic defense against the danger stemming from the caregiver's perceived failure to be available as a protector. The cost of this self-protective strategy is high: toddlers showing inhibition of exploration are often delayed in language and symbolic play.

Role reversal: precocious competence in self-protection This pattern of secure base distortion is characterized by an apparent reversal of roles between attachment figure and child. In this pattern the toddler is unusually attentive to the mother's moods and particularly to her signals of sadness or distress, solicitous towards her, and engaging in caring behavior ordinarily expected of the mother towards the child. A notable aspect of this pattern is that it takes place without apparent effort on the child's part. Precocious competence is not readily interpreted as a distortion of secure base behavior because it does not involve outward manifestations of imbalance between attachment and exploration, but a secure base distortion may be inferred because the toddler takes over substantial portions of the mother figure's protective role, for example by running to keep up with her when she walks ahead in an unfamiliar setting like the street or a store assuming that the toddler will follow.

Multiple factors may be at work in shaping the specific forms of secure base distortion adopted by different children. Temperamental propensities may play a significant role, with toddlers who have a constitutional wariness to novelty perhaps more likely to inhibit exploration, toddlers with high activity levels more likely to become reckless, and toddlers with unusually well-developed executive functions more likely to show role reversal and precocious competence in self-care. Other significant etiological factors may involve caregiving and socialization practices, cultural mores, gender expectations, modeling by significant adults and siblings, the family profile of protective and risk factors, and parental attributions to the child. A developmental psychopathology perspective suggests that a multifactorial model where a variety of mechanisms may play significant roles for individual children's developmental trajectories and whether these distorted patterns continue and become increasingly rigid or resolve into more adaptive functioning.

The Relational Origin of Clinical Defenses in Toddlerhood

Defenses against anxiety are ubiquitous starting in infancy and include such manifestations as avoidance of the attachment figure, freezing, fighting, dissociation, transformations of affect, reversal, and identification with the aggressor (Fraiberg, 1981). The transactions between young children and their attachment figures always involve a continuum of costs and benefits that are gradually established through the mutual adaptations of parent and child. The greater the demands for the child to master fear and anxiety without the help of the parent figure, the costlier the adaptations for the child in terms of freedom of expression of temperamental characteristics, age-appropriate developmental needs, and personal preferences. Secure base distortions and defenses are costly defensive adaptations to anxiety-arousing caregiving conditions because they may endanger the toddler, deprive the child of opportunities to engage with the environment and learn, and suppress the child's expression of need for nurturing care.

The genesis of toddlers' defenses is most expeditiously traced back to patterns of caregiving by the child's attachment figures. The caregiving motivational/behavioral system does not operate only in relation to the child's attachment system but also in the context of other motivational systems within the parent (Hinde, 1989). Parents are not only caregivers but also have other identity facets and social roles. Parents' motivations towards their children are informed not only by the desire to meet the child's needs but also by their own conscious and unconscious wishes, goals, and needs, which often take precedence for primacy and gratification over their

attunement to the child. As toddlers become increasingly autonomous and self-assertive, the emergence of motivational systems like aggression and sexuality in the child has an impact on the caregiving system because the parent may become afraid, angry, or sexually aroused in response to the child's aggression, defiance, or sexual exploration. When the caregiving system is overshadowed by other motivations, the parental spontaneous reactions are often at odds with developmentally appropriate responses to the child.

While the toddler makes momentous leaps in cognition and mental representation, the toddler's body remains the theater for much developmental change. There is research evidence that 24 months of age represents the peak incidence of aggressive behavior during the life course and toddlers have the capacity to hurt siblings, parents, pets, and peers (Shaw et al., 1994; Tremblay et al., 2004). They hit, bite, kick, pinch, pull hair, and engage in other aggressive behaviors, particularly as a response to intense displeasure, conflict, and frustration. There is also much observational documentation of genital arousal and pleasurable play with the genitals beginning in infancy, with a qualitative change in the second year of life characterized by focused intentionality and a range of moods from soft self-touching to excited vigorous activity, often accompanied by sweating and flushing of the face (Roiphe & Galenson, 1981). Toddlers may ask to look and touch the parents' genitals, ask the parents to touch their genitals, and rub themselves against the parent or put the parent's hand on their own genitals (Lieberman, 1993/2018). The toddler's expressions of anger, aggression, and sexual curiosity and arousal can become focal points for conflicts between parents and toddlers when parents feel alarmed, unprepared, triggered, or aroused by their child's behavior. These conflicts can become internalized by the toddler when parents enact violations of boundaries or other pathogenic patterns at the interface between attachment, sexuality, and aggression.

Negative parental attributions play an important role in the etiology of defenses in toddlerhood. Parental attributions are fixed beliefs that the parent has about who the child is and that the parent experiences as accurate, factual, and objective. They run the gamut from unrealistic idealizations at one extreme, through mostly benevolent or mildly critical attributions, to rigidly malevolent perceptions of the toddler as inherently flawed ("he is evil") or attributing to the toddler characteristics that are completely inappropriate to the child's age ("she is a sex goddess"). Many of the rigidly negative parental attributions have aggressive or sexualized content and carry the imprint of traumatic experiences from the parent's childhood. Toddlers tend to respond to parental negative attributions by accepting their veracity, perceiving themselves as the parent perceives them, and enacting those attributions in an early manifestation of projective identification (Lieberman, 1999). The toddler's compliance in turn confirms for the parents the accuracy of their perceptions, and child and parent become locked in a sad transmission of intergenerational trauma that Selma Fraiberg described as "ghosts in the nursery" (Fraiberg et al., 1975).

The Interplay of Biology and Attachment in Toddler Development

Successful navigation of the challenges faced by toddlers requires exercising their blossoming executive functioning skills, defined by Diamond (2013) as "a family of top-down mental processes needed when you have to concentrate and pay attention, when going on automatic or relying on instinct or intuition would be ill-advised, insufficient, or impossible." Executive function includes cognitive skills such as planning, organizing, time management, and task initiation and completion, and these in turn are shored up by the capacity for self-awareness, self-monitoring, emotional control, and response inhibition.

Executive functioning skills are thought to rely heavily on the prefrontal cortex, which develops very rapidly during toddlerhood with synapse overproduction that peaks around

15 months of age and is followed by a slow and steady process of building brain structure through pruning and myelination that continues into adolescence (Huttenlocher & Dabholkar, 1997; Kolb et al., 2012). Pruning is the process by which the extra synapses are trimmed away to reach adult numbers. Myelination is the process by which synapses are wrapped in a protective sheath to improve efficiency. Synapses that fire infrequently are pruned away, while heavily used synapses are upgraded, leading to a long period of "use it or lose it" (Power & Schlaggar, 2017).

In tandem with this rapid brain development, toddlers' self-regulatory and executive function skills improve more rapidly during the toddler and preschool period than at any other time during the lifespan (Zelazo & Carlson, 2012). Rudimentary executive functioning skills can be measured in toddlers as young as 14 months using experimenter-led behavioral tasks, such as a task in which toddlers are instructed not to touch an interesting toy and their latency to touch is measured (Devine et al., 2019; Friedman et al., 2011). Performance on such a task improved substantially from 14 to 36 months—in one longitudinal study, 11% of children were able to wait 30 seconds before touching the toy at 14 months of age, while 65% succeeded at 36 months of age (Friedman et al., 2011).

In a classic study, Kochanska et al. (2001) used observational methods in the lab to measure "do" and "don't" compliance in 108 toddlers. In the "do" context, mothers were instructed to request that children clean up toys. In the "don't" context, mothers were instructed to prohibit toddlers' from playing with attractive toys. The researchers found that toddlers' "committed compliance", or eager compliance with maternal commands without maternal intervention, increased steadily from 14 to 33 months of age, with the greatest gains happening from 14 to 22 months. Thus, toddlers' emerging executive functioning skills underlie measurable changes in compliance behaviors that are important for success in social contexts.

The executive functioning groundwork laid out in toddlerhood has important implications for the rest of the lifespan. Executive functioning abilities measured early in life consistently predict important outcomes later in life (e.g. Blair & Razza, 2007; Mischel et al., 2011; Moffitt et al., 2011). In a seminal longitudinal study, Moffitt et al. (2011) found that performance on a battery of childhood self-control measures predicts a gradient of physical health, substance dependence, finances, and criminal outcomes at age 32. The researchers followed a complete birth cohort of all 1037 children born in Dunedin, New Zealand in 1 year, maintaining a 96% retention rate from birth to age 32. Self-control was measured at ages 3, 5, 7, 9, and 11 via observational (ages 3 and 5) and informant-report (ages 5–11) measures. Adult outcomes were measured at age 32 via examinations, blood tests, interview, record searches, and informant-report measures. The researchers found that, regardless of informant, children with less self-control had worse health, less wealth, and committed more crime at age 32. These results held when controlling for childhood social class.

Brain development in toddlerhood does not unfold in a vacuum, but is instead firmly placed within the environment, including the social context (See Part 2, this volume: Neurobiological Influences). Rather than being biologically predetermined, the development of the prefrontal cortex is enormously open to environmental input. Evolutionarily speaking, this plasticity is advantageous as it allows humans to adapt the development of the brain architecture underlying their most complex behaviors to appropriately suit the environment in which they will live.

Prefrontal development occurs at its most rapid pace when children are at an age when they spend more time with, and are more influenced by, their parents. Within the developmental literature, parenting behaviors are well known to relate to executive functioning skills, with early childhood acting as a potential critical period (see Valcan et al., 2017 for a meta-analysis). Across

42 studies, 31 of which were longitudinal, parenting behaviors that promote secure attachment (e.g., warm and supportive parenting) were associated with better executive functioning skills, while the opposite was true for parenting behaviors that might undermine attachment (e.g. harshness, excessive control; Valcan et al., 2017). Thus, it is perhaps unsurprising that secure attachment promotes the development of executive functioning skills (see Pallini et al., 2018 for a meta-analysis). In fact, recent longitudinal work showed that toddlers with better attachment security at age 15 months performed better on self-regulation tasks several years later, at age 5 (Bendel-Stenzel et al., 2022). Toddlers use the gentle pull of the attachment context in order to learn, through trial and error, to successfully navigate the world around them.

Attachment unfolds in the context of family relationships. The family environment can be one of safety and learning, an organizing context in which children know that their needs will be met and can learn and practice basic life skills. The family context can also be disorganizing and stressful. Repetti et al. (2002) characterized "risky families" as those characterized by overt family conflict, including anger and aggression, and deficient nurturing. The authors proposed, based on a review of the empirical evidence, that risky family environments are associated with a cascade of deleterious effects, starting with effects on stress-responsive biological regulatory systems, emotional processing, and social competence in infancy and toddlerhood. Since this proposal, thousands of empirical articles have tested various aspects of the model. One such study by Sturge-Apple et al. (2012) examined stress reactivity in 201 toddlers with exposure to family violence. The authors found that risky family contexts, including maternal unavailability and interparental violence, were associated with changes to children's stress reactivity (Sturge-Apple et al., 2012). Relatedly, a longitudinal study by Brown et al. (2013) demonstrated that family instability and chaos predicted preschoolers' inhibitory control and school readiness at the end of the preschool year.

The Environmental Matrix of Toddler Development: Risk and Protective Factors

Just as attachment unfolds in a family context, the family operates in cultural and social contexts that may support, restrict, or actively harm individual and relational health. As described by Bronfenbrenner and Morris (2006), individuals develop within multiple nested environmental contexts. Sameroff's (2009) transactional model of development illustrates how these contexts influence each other and are simultaneously influencing and influenced by the developing child.

Socioeconomic circumstances are a major contributor to the child's opportunities to explore and learn safely, and childhood socioeconomic disadvantage can undermine the development of executive functioning starting in infancy. Meta-analytic evidence identifies a consistent relationship between socioeconomic disadvantage in childhood and worse executive functioning performance, with the largest effect sizes coming from studies with meaningful socioeconomic variability and multiple measures of executive functioning (Lawson et al., 2018). Recent research suggests that income explains up to 6% of the variance in preschool functioning (Kohen & Guevremont, 2014) and that 17.4% of children living in poverty show early-onset behavioral problems (Holtz et al., 2015). Socioeconomic disadvantage manifests in many ways, including affecting where children and families live. A growing literature indicates that neighborhood characteristics may influence the development of executive functioning, even when accounting for family-level considerations like income and education (e.g., Hackman et al., 2021; Tomlinson et al., 2020). Neighborhood contexts confer risk beyond family-level socioeconomic status because they are associated with unique adverse experiences such as neighborhood violence, under-resourced schools, toxicant exposure, and absence of promotive factors like parks, playgrounds, community centers, and grocery stores with fresh food (Evans, 2004; Leventhal & Brooks-Gunn, 2000). Neighborhood-related

stressors in the absence of protective factors may generate "wear" on stress regulatory systems, with implications for the brain structures important for executive functioning (Finegood et al., 2017). The impact is as relevant for infants and toddlers as it is for older children and adults. For example, disadvantaged neighborhood contexts are associated with chronically high cortisol levels in 7- to 24-month-olds (Finegood et al., 2017). This is an important and worrisome finding because while moderate levels of cortisol support the body's adaptive fight-or-flight response, chronically high levels can damage brain tissue and other tissues within the body, with negative consequences for physical health, learning, and mental health (Finegood et al., 2017; Gunnar & Quevedo, 2007).

Race is a socially defined construct that is also associated with neighborhood poverty, illustrating the pervasive influence of racism on health disparities starting in infancy (see Adkins-Jackson et al., 2022 for an overview). The historical practice of "redlining" in the United States restricted the flow of resources into communities labeled as "hazardous", a practice that largely affected neighborhoods where Black families lived and severely limited housing and economic opportunities for these families (Mitchell & Franco, 2018). The long-term sequelae of this public policy are still evident, with research findings showing that Black and Brown families are more likely to live in impoverished neighborhoods than White families and that 60% of poor neighborhoods are presently inhabited by minoritized racial and ethnic groups (Mitchell & Franco, 2018; Osypuk & Acevedo-Garcia, 2010; Pastor, 2001). Black families and families from minoritized groups are more directly affected by violent police tactics in impoverished neighborhoods and in the community, further taxing stress regulatory pathways (Alang et al., 2017). These sociological conditions have direct repercussions for caregiving because parental stress over safety for themselves and their children affects parental frame of mind, parenting practices, and young children's own emotional responses to these circumstances.

The convergence of biology and sociology in predicting child development and physical and mental health outcomes starting in infancy is a recurrent theme that was aptly highlighted almost a quarter of a century ago in the Institute of Medicine's report, *From Neurons to Neighborhoods: The Science of Early Childhood Development* (Shonkoff & Phillips, 2000) and continues to have detrimental effects for children and families from low-income and racial/ethnic minority groups. It is imperative that clinicians cultivate this understanding in their assessment and treatment of toddlers and their families. This perspective is incorporated in the following sections, which address the impact on toddlers of violence and other traumatic events, diagnostic considerations, and effective approaches to treatment.

The Impact of Neglect, Trauma, and Adversity on Toddler Mental Health

Exposure to neglect, trauma, and other adversities during early childhood is associated with risk for the development of psychiatric disorders both in childhood (Green et al., 2010; Teicher & Samson, 2016) and in adulthood (see McKay et al., 2021 for a systematic review and meta-analysis), with an additive effect of adversity exposure on risk for any psychiatric disorder rather than a one-on-one correspondence between a specific adversity and a psychiatric disorder. In one study, Green et al. (2010) found that childhood adversities explain 44.6% of childhood-onset psychiatric disorders, with maladaptive family functioning (family violence, physical abuse, sexual abuse, neglect, parental mental illness, and criminal behavior) showing the strongest predictive effect.

The impact of adversity on the brain has emerged in recent decades as a major mechanism underlying the association between early childhood adversity and mental health. Longitudinal research with institutionally reared infants has shown clear neurobiological consequences of physical and emotional neglect in infants and toddlers, including widespread differences in gray matter and white matter volume (Sheridan et al., 2012), metabolic differences within the

prefrontal cortex and amygdala (e.g., Chugani et al., 2001) and structural differences within the amygdala (Tottenham et al., 2010). Behaviorally, these researchers found that institutionally reared children had difficulties with emotion regulation (Tottenham et al., 2010) and increased impulsivity, attention problems, and social difficulties (Chugani et al., 2001).

Although improvement is possible with improved child rearing conditions, the findings are nuanced. One randomized controlled trial, The Bucharest Early Intervention Project, assigned toddlers (mean age = 22 months) to either a foster care intervention or to remain in institutional care (Sheridan et al., 2012; Zeanah et al., 2003). Sheridan et al. (2012) found that any history of institutionalization, regardless of intervention, was associated with reduced cortical gray matter volume. However, the researchers also found that children who were randomized into foster care had white matter and corpus callosum volumes that were comparable to children who were never institutionalized, representing a potential "catch up" to their peers. In another longitudinal study of 110 children who were adopted from an institutional setting during infancy or early toddlerhood (median age at adoption = 12 months), Hodel et al. (2015) found that the prefrontal cortex was particularly susceptible to early adversity. The researchers found that 13- and 14-year-old children who had been institutionalized in early childhood had significant reductions in prefrontal cortex volume, and that the prefrontal cortex was more affected than any other brain region. Taken together, the results of these two studies indicate that patterns of cortical development occurring in infancy and toddlerhood may present a sensitive period in which exposure to extreme adversity leads to long-lasting changes in cortical structure.

In addition to work on institutionalization, the past 15 years have seen an increased focus on studying the neurobiology of exposure to childhood trauma. Due to methodological constraints, childhood trauma is often measured through retrospective self-report, and work on the brain correlates of exposure to trauma during toddlerhood specifically is lacking (De Young et al., 2011). In a sweeping review of the growing body of literature on the brain correlates of childhood trauma more broadly, Teicher and Samson (2016) found 41 studies reporting an association between childhood trauma and differences in prefrontal cortex structure and function. Generally, exposure to trauma was marked by attenuation of prefrontal regions, as measured by reduced volume or activation. Teicher and Samson (2016) also found consistent evidence within the literature for alterations to the corpus callosum, hippocampus, and amygdala.

In the context of these strikingly consistent effects of trauma on the brain, Teicher and Samson (2016) proposed that childhood trauma affects early brain development to facilitate survival in the world as the infant or toddler is experiencing it. When young children experience a world that is scary and unpredictable, their brains build the appropriate architecture to thrive in such a world. As one example, in another review, McLaughlin and Lambert (2017) identified trauma-related disruptions in the brain circuitry underlying threat processing. Pulling from multiple studies, they described consistent evidence that children exposed to trauma demonstrate a sensitivity to "anger" cues and heightened attention to, and difficulty disengaging from, threat cues. As these children grow, they may find that the world they encounter is different from the world their brain was built to survive, leading to adjustment challenges and even to psychiatric disorders. This model reflects a movement in the neuroscience field to understand children as "learning machines" with growing and changing brains that adapt to current environmental conditions (e.g., Frankenhuis et al., 2016).

The Challenge of Diagnosing Toddlers

Emotional difficulties are common in the first years of life but tend to be overlooked, minimized, or dismissed because of the pervasive motivation to idealize childhood as a carefree time where challenges always have happy endings (Keren et al., 2017). Diagnosing mental health disorders at any age often evokes concern about labeling and stigmatizing people. This con-

cern is particularly applicable to infants and toddlers, whose rapid pace of developmental change raises the question of temporality: are the child's difficulties stable or will the problems "pass in time", as many well-wishers reassure worried parents? In response to these concerns, it is important to clarify that clinicians classify disorders, not individuals. In the words of Robert Emde (2016, viii), diagnostic formulation involves "careful history taking in caretaker interviews, direct observations, clinical empathy, and holistic judgments in which patterns of child behavior and experience are taken into account". Perhaps most crucially, diagnostic formulation legitimizes the significance of young children's distress and opens opportunities for timely intervention that may relieve pain, prevent the consolidation of maladaptive patterns, and alleviate the impact of mental health and developmental conditions when early identification improves outcome.

Careful history taking is a time-honored element of best clinical practice in developing a diagnosis. Less widely implemented is screening for the specifics of what happened to the child—including the stressors and traumatic events the toddler experienced, witnessed, or learned about. As a result, toddlers' symptoms are often misinterpreted as behavioral or developmental problems when they are manifestations of traumatic stress responses (Crusto et al., 2010). The disproportionate exposure of infants and toddlers to violence, maltreatment, and accidental injury, and the tendency of parents and caregivers to downplay these events make it imperative to use systematic trauma screening as an integral component of clinical assessment to help determine whether emotional and behavioral symptoms may be traced to trauma exposure, a practice recommended by the American Academy of Child and Adolescent Psychiatry (2010).

Approaches to Toddlers' Mental Health Treatment

Effective and comprehensive mental health treatment with young children must incorporate six key elements: (1) a developmental perspective; (2) focused attention to child-parent(s) relationships within the broader context of family relationships; (3) knowledge of real-life events and family circumstances; (4) respectful sensitivity and responsiveness to the family's cultural values, beliefs, practices, and the historical experiences and current social conditions of the family's racial/ethnic/national/religious group; (5) imbuing hope by bringing awareness to areas of strength and goodness and creating a sense of joyful possibility that things can get better; and (6) cultivation of a caring and genuine therapeutic relationship as a fundamental mutative factor in treatment.

Some of these elements might have a different salience in the treatment of an individual toddler depending on the circumstances of the referral and particular clinical configuration, including parental motivation for treatment and degree of alignment between the parents and clinician about the nature of the toddler's difficulties and the preferred treatment approach. Different elements might also be salient at different stages of treatment. In some cases, the parents' negative attributions to the child are so urgently damaging that the child's symptoms seem inextricably tied to these attributions, raising the question of whether to prioritize the child's presenting problems or the parents' distorted perceptions as the initial focus of treatment. When treatment is mandated by the judicial system, the first step might be to cultivate the therapeutic relationship to build the parents' trust – a process that might be lengthy and arduous when the parents have been repeatedly marginalized or abused by systems of care. When parents seek treatment voluntarily, on the other hand, parental spontaneous collaboration with the clinician might be an implicit protective factor that gives momentum to treatment progress. The parents' and clinician's familiarity and comfort with each other's cultural background might influence the salience of this element in treatment. The larger the gaps in knowledge, the more active and conscientious the clinician needs to be in learning about the sources of diversity that might create obstacles to the working alliance on behalf of the child.

An essential starting point for health-promoting childrearing practices and clinical interventions is to understand and legitimize the toddler's subjective experience while also attend-

ing to the circumstances and needs of the child's attachment figures, who themselves must find ways of integrating their multiple roles as the child's caregivers, commitment to other relationships, and need to meet economic needs and social demands. The rapid pace of developmental change in the first years of life calls for a continuous process of assessment in tandem with intervention. This process involves careful extended observations, gathering data from the range of physical and social settings where the toddler spends time, and elucidation of the interplay among biological, interpersonal, social, and cultural risk and protective factors, including the acuity and chronicity of their impact on the child.

Different treatments can be broadly classified under two different psychotherapy traditions. One tradition is psychodynamic, as represented in Selma Fraiberg's infant–parent psychotherapy (Fraiberg, 1980) and expanded in Child–Parent Psychotherapy to focus on trauma-exposed infants, toddlers, and preschoolers (Lieberman & Van Horn, 2008; Lieberman et al., 2015). In this tradition, understanding the child and the parents' inner world, perceptions of each other, and meaning of behavior is the underlying principle guiding overarching clinical formulation and specific interventions. The other tradition is cognitive-behavioral, as represented in Parent–Child Interaction Therapy (PCIT) (Stevens & N'zi, 2019). In this tradition, positive caregiver–child interactions are promoted and maladaptive behavior is shaped through the deployment of reward and selective attention strategies.

The collaborative, relationship-based spirit of the infant mental health field is reflected in the mutual influences between these two traditions and the openness of practitioners across both traditions to learn from each other. Clinicians working from a psychodynamic perspective often incorporate cognitive-behavioral strategies as a treatment modality, whereas cognitive-behavioral clinicians are deeply cognizant of the importance of the child–parent relationship and use intervention strategies that promote secure attachments. Both types of approaches routinely make use of psychoeducation and developmental guidance to expand parental and child understanding and enrich their interactive repertoire.

Manualized evidence-based treatments have the advantage of providing a roadmap for clinicians that helps them find their bearings while encountering the multiple and complex layers of child and family psychopathology. The risk is that dutiful allegiance to prescribed treatment modalities might detract from the clinician's sensitive attunement and responsiveness to the spontaneous flow of what child and parent might be conveying in the moment. Psychological maturity calls for the capacity to embrace, contain, and integrate polarities of motivation and affect: intimacy and autonomy, fear and courage, love and hate, strength and vulnerability, self-care and generous giving to others. Toddlers and parents are engaged in this psychological journey both as individuals and in relation to each other. Clinicians can best help them when they move organically between disciplined practice and intuitive understanding and response.

Summary and Key Points

Toddlerhood is a time of rapid growth and change, shaped by the core motivations of fear, attachment, and exploration. Understanding the four core fears—fear of separation and loss, fear of losing love, fear of body damage, and fear of being bad—can provide insight into toddlers' seemingly irrational behaviors. These fears are alleviated by the attachment bond, which increases a child's odds of survival by promoting proximity to a caregiver, who provides protection from danger. These secure attachments are built by deeply felt emotional exchanges as well as by consistent attunement in the context of cultural values and practices. A psychologically secure toddler can move organically from seeking proximity and contact with the caregiver to exploring on his or her own. Regarding brain development, toddlers' self-regulatory skills and related brain structure change more rapidly during the toddler period than at any other time during the lifespan. This development occurs within social context

and can be undermined by early life adversity. Regarding diagnosis of toddlers, emotional difficulties are common in the first years of life but tend to be minimized due to fears around stigma and a motivation to idealize childhood as a carefree time. However, diagnostic formulation can legitimize young children's distress and open opportunities for timely intervention. Regarding treatment, clinicians should understand and legitimize the toddler's experience while also attending to the circumstances and needs of the child's attachment figures.

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Childcare in Crisis: Mental Health and the Preschool Expulsion Epidemic

7

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Early childcare professionals not only provide a vital public service but also shepherd children through a formative stage of development. The first 5 years of life are both the most opportune and the most vulnerable for setting children on a trajectory of success or failure (Meek & Gilliam, 2016). More than 1 million new neural connections form every second in the brain of a child under 4 (Harvard Center on the Developing Child, 2019). While this period of rapid growth provides remarkable opportunities, it can also leave young children highly vulnerable to negative impacts on their social, emotional, and cognitive development. For many children, the legacy of this sensitive time will be defined by the quality of early childcare programs they access because high-quality early childhood experiences can be beneficial to their development, whereas poor-quality experiences can be harmful (Crnic et al., 2005; Phillips et al., 2001). High-quality early care and education programs can help mitigate the effects of parental stress by providing children with verbal and cognitive stimulation, responsiveness to their emotions, attention, and support (Phillips & Lowenstein, 2011). This gives children tools to advance their development compared to peers who do not have such adult–child interactions. However, this opportunity for learning, growing, and forming relationships is not always accessible to all children.

The Expulsion Epidemic in Early Childhood Programs

According to the 2016 National Survey of Children's Health, an estimated 17,000 children were expelled from preschools across the United States (US Department of Health and Human Services, 2016). While there is limited research on preschool expulsions outside of the United States, inadequate provision of childcare and lack of preschool expulsion regulation has been recorded in several countries. In the United Kingdom, a 2016 report found that "only 45 percent of councils in England and Wales had enough childcare available for parents who work full time" (Rutter, 2016, p. 4). Although regulation of expulsions in preschools is often lacking, a UK Department for Education report recorded the exclusion of children as young as 2 years from nursery schools and their subsequent

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referral to Pupil Referral Units (Ofsted, 2022). In Canada, a 2012 report conducted by the Canadian Child Care Federation concluded that there were only enough regulated and licensed childcare spots to accommodate 22.5% of Canadian children aged 0–5 years (Friendly et al., 2013). Though data on expulsion frequency in childcare programs are not kept by provinces, an article published by the Childcare Resource and Research Unit of Canada recorded multiple anecdotal cases of expulsions (Quan, 2018). While further research investigating preschool expulsion rates outside of the United States is needed, the limited sources that exist suggest that the challenges of preschool expulsions may be present in regions beyond the United States. However, due to the lack of existing data, this chapter deals primarily with preschool expulsions in the US childcare system.

In the United States, studies on exclusionary discipline have found 1- to 4-year-olds to be at the greatest risk, being expelled at a rate three times that of children enrolled in K-12 education (Zinsser et al., 2022). Early childhood education has been envisioned as a means to close inequality gaps and remedy social injustices. In practice, however, the expulsion epidemic in early childcare further entrenches divides by closing students out of opportunities and perpetuating poor developmental outcomes that stem from systemic barriers or adverse experiences (Fabes et al., 2020; Gilliam, 2016).

In an interview for NBC News conducted by Einhorn (2019), a mother sharing her story with an interviewer recalled her son's distress at being rejected from one preschool after another. The 3-year-old, expelled for biting, shoving, and, in one case, hitting another child with a rolling pin, was left feeling hopeless. "He was telling me he was bad," the interviewer recorded. "He couldn't control his impulses and felt bad about himself afterwards."

While sending a 3-year-old home from a preschool program may not seem too derailing, it can have serious and long-lasting consequences in setting a child on a trajectory of increased exclusion from society, particularly when combined with other adverse experiences in childhood (Dodge et al., 1990; Eiden et al. 2009; Fitzgerald et al., 2002; Shaw et al. 2001). Students who are expelled or suspended are as much as ten times more likely to drop out of high school and are much more likely to have a negative attitude toward school (American Psychological Association, 2008; Council on School Health et al., 2013; Meek & Gilliam, 2016). Furthermore, preschool expulsion can foreshadow later adult incarceration, especially for children who are exposed to adverse childhood experiences. Once expelled from early childcare, a child has a much higher likelihood of being expelled or suspended again, struggling academically, dropping out of school, or later being incarcerated – a "preschool to prison pipeline," or perhaps "cradle to prison pipeline," with devastating and costly consequences (Gilliam, 2016; Meek & Gilliam, 2016). Thus, early expulsions may set in motion a cascade of negative interactions with schools and close a child off from possible support.

Many of the impacts discussed are cyclical and intergenerational. A child of incarcerated parents is three times more likely to be expelled from an early education program (Pew Charitable Trust, 2010; Zeng et al., 2019). Stopping this damaging loop at the preschool level allows early education to act as part of a remedy for social inequality rather than as a potential perpetuator of future harm.

The Impact of Gender and Minority Biases on Expulsion Rates

Across the United States, expulsion statistics show striking racial and gender disparities, with boys and Black children most at risk, as well as increased rates for young children with disabilities (Zeng et al., 2020). While representing only 54% of preschool enrollment, boys make up 79% of children suspended once and 82% of children suspended multiple times (US Department of Education, 2014). In March 2014, the Department of Education's Office of Civil Rights released a report, which found that Black preschoolers are twice as likely as White preschoolers to be expelled. Furthermore, they showed that they are

disproportionately expelled as Black children make up 18% of preschool enrollment, but 48% of preschool children suspended more than once (US Department of Education, 2014, 2016). These findings echo similar gender and race disparities found a decade earlier in the first national study of preschool expulsion and suspension (Gilliam, 2005).

The factors leading to the disproportionate exclusion of boys and children from marginalized communities are still an open question. One element may be the teacher's perception of students and implicit bias. A 2016 study found that teachers more closely scrutinized Black and male students when asked to watch for negative child behaviors, demonstrating expectations of misbehavior that could become self-fulfilling (Gilliam et al., 2016a, b). Another study found that Black elementary students were more than twice as likely as their White peers to be referred to the principal's office, expelled, or suspended for challenging behaviors (Skiba et al., 2011). The study compared the types of infractions for which African American and White middle school students were referred to the office found no clear differences in severity of behavior, but, nonetheless, Black students were referred for discipline more often for offenses that required a higher degree of subjectivity, such as disrespect or loitering.

Relationship Between Adverse Childhood Experiences and Likelihood of Expulsion

Children most in need of high-quality early education may be the ones most likely to be expelled. A growing body of research indicates that children are more likely to be expelled when they have experienced a greater overall amount of childhood adversity (Zeng et al., 2019; Zinsser et al., 2022). The effect of these adverse childhood experiences (ACEs) is interactive. Exposure to adverse childhood experiences negatively impacts neurobiological development and self-regulatory processes, contributing to poor emotion and behavioral self-control, as well as a heightened reactivity to stimuli that might trigger a trauma response (Johnson et al., 2021).

While further research is needed to understand the links between ACEs in early childhood and classroom behavior, ACEs are strongly associated with both externalizing and internalizing behaviors in middle childhood (Hunt et al., 2017), behaviors that can present challenges for teachers. A host of ACEs have been associated with preschool expulsion (Zeng et al., 2019). More specifically, children whose parents were divorced or incarcerated have a three times higher risk of being expelled, and children who live in poverty have an almost four times higher risk. Living with adults who engaged in substance abuse carries an almost five times greater risk, and living with a caregiver with a mental illness is associated with an almost ten times higher risk of preschool expulsion. Furthermore, witnessing or being a victim of domestic violence is linked with more than a ten times higher chance of being expelled or suspended (Zeng et al., 2019, 2020; Zinsser et al., 2022). Multiple ACEs may interact with one another, stacking the odds against a child.

Tragically, many of the abovementioned ACEs may be associated with a breakdown of a close relationship with a caregiver. For these children, losing access to dedicated caregivers at home puts them at greater risk of losing their school caregivers as well (Allen & Gilliam, 2023). Thus, as children are expelled from preschool programs, they lose not only the chance to learn and socialize with other students, but also access to adult role models and the stable, loving relationships that high-quality early childhood education programs may provide (American Psychological Association, 2008).

Pressures on the Early Education Sector

Although some early childcare programs in the United States are able to provide high-quality care for students and robust support for educa-

tors, not all are able to do so due to lack of funding and government support and other factors. Circumstances and the resources available strongly influence whether a childcare professional can cope with challenging child behaviors. While central to the learning and development of the over 10 million children across the United States, early childcare professionals are put under many pressures, including long hours, poor work conditions, and inadequate governmental support. The childcare profession is also one of the lowest-paid occupations in the United States, with an annual salary 67% below the national average (Chang, 2020). These challenging conditions and lack of compensation manifest in a high staff turnover, poor health conditions, high rates of burnout, and emotional exhaustion (Elharake et al., 2022).

Expulsions are significantly more likely in cases where teachers report high levels of job stress or work extended hours (eight or more per day; Gilliam & Reyes, 2018; Gilliam & Shahar, 2006). The greater the pressure a teacher is under, the greater the likelihood of an expulsion decision. Teachers under high pressure, via stress, burnout, or depression, often struggle to meaningfully engage with children and thus are more likely to respond harshly to children's behaviors and feel unable to cope with classroom problems children present, causing them to turn to expulsion as a last resort. In contrast to childcare programs where teachers are well-supported, children with stressed teachers are more likely to exhibit behavioral challenges and poorer skill development (Hanno et al., 2022; Martin et al., 2017). Young children under stress, in turn, are more likely to act out and draw on a teacher's limited resources. A 2017 study analyzing childcare providers' accounts of expulsion noted a pattern leading to expulsions: having exhausted the resources at their disposal, a teacher chose to expel once they felt they had no other option, particularly when they believed parents were unable to work with them. A teacher recalled telling a parent, "We're at our endpoint, we can't do anything more for him, we've done as much as we can…" (Martin et al., 2017).

Covid-19 and Further Strain on Childcare Professionals

Childcare is essential work, a fact made strikingly evident through the Coronavirus (Covid-19) pandemic. As our reliance on the ability of thousands of essential workers became obvious, so did the sacrifices of thousands of early childcare professionals who made it possible for parents to leave their children behind and perform their vital jobs. About 30% of the healthcare workforce has children that are too young to be left home by themselves (Ruggles et al., 2023). Without early childcare professionals, these essential healthcare workers would not have been able to provide medical services during the pandemic. Over the course of the pandemic, however, many childcare professionals found themselves under financial, mental, and physical pressure with limited support resources (Elharake et al., 2022).

Mental health plays a critical role in an educator's ability to manage and assess children's challenging behaviors. Preschool teachers who screen positive for depression expel at about twice the rate of those who do not (Gilliam, 2008; Gilliam & Shahar, 2006). Before the pandemic, rates of clinical depression within the childcare profession were comparable to overall US rates, ranging from 16.0% to 36.1%. During the early months of the global Covid-19 pandemic, however, depression among childcare professionals increased to a rate of 45.7% (Elharake et al., 2022). This rate was much higher than the general estimate for US adults during the pandemic, which remained between 27.8% and 32.8%. Additionally, around two-thirds of childcare professionals reported moderate to high stress levels, almost twice the national estimate for US adults (Elharake et al., 2022).

By January 2021, over a quarter of a million cases of Covid-19 were being reported each day. Though providing an essential service to children across the country, early childcare providers were given limited support, lost in a sea of changing guidelines, and obscure paths to relief funding. Despite working on the front line and having close contact with first responders' children,

early childcare professionals were not included in the first round of vaccine distribution (Patel et al., 2021; Patel et al., 2022). Fifteen months into the pandemic, 21% of early childhood educators had tested positive for Covid-19, 3% had been hospitalized, and 2% had a house member hospitalized (Gilliam et al., 2021).

As part of an oral history of US childcare professionals during the Covid-19 pandemic (EdSurge, 2021), the experiences of several childcare professionals illustrated the stress experienced by those providing paid care for young children. For example, one early educator and childcare program owner described her experiences when the Covid-19 pandemic struck less than 1 year after she had opened her program. Her home-based program served children ages 0–5 years throughout the pandemic. She described "going into survival mode – what's going to happen next? Can I pay my rent for next month? What happens when the loan is depleted?" (Sullivan, 2021). A different childcare owner and director said: "We still [had] to hug the babies. We still [had] to pick up the babies. We still [had] to change the babies' diapers" (Sullivan, 2021). Yet another childcare professional summed up her experiences by stating, "at the end of the day, these are the risks we are taking. We're at a higher risk." (Burstein, 2021).

Childcare professionals experienced high rates of Covid-19 mortality during the first year of the Covid-19 pandemic. In 2020, for every 100,000 US childcare professionals, 38 died due to Covid-19, compared to 15 for every 100,000 K-12 teachers (Chen et al., 2022). These increased Covid-19 mortality rates may be a reflection of disparities in working conditions, as childcare centers are often located in poorly ventilated spaces such as basements, especially in economically disadvantaged areas (Elharake et al., 2022). Furthermore, the heightened risk of severe illness or death could be related to the higher incidence of Covid-19 risk factors among early childcare educators, particularly those of color (Gilliam et al., 2021). Throughout the Covid-19 pandemic, people of color were at a disproportionate risk of dying from Covid-19 when data were adjusted to account for age differences (Centers for Disease Control and Prevention, 2022). In a large national epidemiological survey, high rates of asthma, diabetes, obesity, and other health conditions were noted for early childcare professionals (Elharake et al., 2022). An asthma rate of 14% was reported for childcare professionals, around 1.2 times the national average for US women. Racial disparities were observed across many of the risk factors, with American Indian, Black/African American, and multiracial educators being at greatest risk. Slightly more than 7% of American Indian/Native Alaskan childcare professionals reported three or more health conditions, placing them at greater risk of serious Covid-19 infection as opposed to 4% for childcare professionals overall.

The childcare sector represents a highly vulnerable workforce, of which 96% are women and 36.2% are people of color, compounding the marginalization of being both in a traditionally underserved racial group and an overlooked profession (Elharake et al., 2022). In addition to the mental health burdens of economic pressures and the fear of contracting Covid-19, early childhood educators of color were also vulnerable to racialized aggression (Palomino et al., 2023). Racialized aggression experienced by childcare professionals during the Covid-19 pandemic was associated with increasing symptoms of depression and stress during the first year of the pandemic (Cobanoglu & Gilliam, 2023). A 2022 project investigating racialized aggression experienced by Asian American early educators found them to be three times as likely as other early childhood educators in the United States to be the target of either physical or verbal racialized aggression (23.1% vs. 7.7%) and to have the highest levels of stress reported during the pandemic (Zhang et al., 2023).

As the pandemic progressed, many parents able to work from home withdrew their children from early childcare centers, wary of being exposed to or spreading the virus. Three months into the global pandemic, 35% of childcare professionals were unemployed (US Bureau of Labor Statistics, 2020). Fifty-four percent of programs were forced to close at some point, with more than one quarter not working from March

2020 to July 2020 (Gilliam et al., 2021). While many early childcare providers accessed loans through the Paycheck Protection Program (PPP) and childcare relief funds, aid was often insufficient to meet mounting costs. For example, only 33% of childcare professionals working in early childcare centers and 24% working in family childcare homes were able to avoid taking on additional debt for their programs during the pandemic (NAEYC, 2021a). Many drew on their savings or used personal credit cards to shoulder the costs of operating.

On top of financial strain, many early childcare centers struggled to retain and recruit educators. Already a profession with a high employee turnover, the instability and unpredictability of the sector through the Covid-19 pandemic led many educators to turn to other professions, causing a staffing shortage, which is likely to hinder economic recovery. Eighty percent of childcare centers responding to a 2021 survey reported that they were experiencing a staffing shortage, with 88% of programs serving families in need of financial assistance reporting greater difficulty in recruiting and retaining educators (NAEYC, 2021b). For many educators, the added risks and pressures of Covid-19 were the last straw, pushing them out of employment in the early childcare sector.

Covid-19 and Further Strain on Children

While childcare centers struggled to keep their doors open and educators coped with mounting pressures, the Covid-19 pandemic also put the children they serve under great strain. Many children's social-emotional development was severely disrupted during lockdown, with a variety of negative impacts, including tantrums, anxiety, clinginess, boredom, and under-stimulation (Egan et al., 2021; Elharake et al., 2022). While further research is needed, there is also evidence that the pandemic was associated with a rise in the number of ACEs children experienced, including the loss of a family member or loved one. Communities of color experienced disproportionate numbers of deaths due to Covid-19, putting children of color at greater risk of adverse experiences (Bryant et al., 2020; Center for Disease Control and Prevention, 2022).

By June 2021, 24% of programs reported having one or more children with a family member hospitalized for Covid-19, 18% reported having five or more children who had had a family member hospitalized, 12% of programs served one or more children who had lost a family member to Covid-19, and 7% recorded five or more children who had experienced the death of a family member due to Covid-19 (Gilliam et al., 2021). Some children brought their experiences of trauma into their already-strained classrooms, increasing their risk of acting out.

Early childcare providers train as educators, not grief counselors, yet they bore the brunt of this emotional burden. By August 2021, childcare professionals were reporting that relative to pre-pandemic expectations, 42% of their children were experiencing more externalizing symptoms of stress (e.g., aggression and hyperactivity), 48% were more internalizing (e.g., social withdrawal), and 38% exhibited greater levels of symptoms that may be associated with physiological responses to trauma (e.g., unexplainable pain and discomfort; Palomino et al., 2023). In a survey conducted in February 2021, nearly 60% of center-based teachers and home providers reported children exhibiting challenging behavior in the previous month, defined as "a repeated pattern of behavior" that made it "difficult for children to play and learn" (Grindal, et al. 2021). With both teachers and students under increased pressure, the Covid-19 pandemic compounded both factors contributing to expulsion rates from early childhood programs (i.e., stressed teachers and stressed children).

Vital Support for Caregivers and Children

Considering the persistent frequency and effects of preschool expulsions, widespread supports are vitally needed. Since the Child Care and Development Block Grant of 2014 (Public Law

113–186) in the United States stipulates that recipient states must reduce expulsion rates, many states have been working to pass further legislation limiting exclusionary discipline in the early years (Loomis et al. 2022). However, forcing overstretched, underfunded, and emotionally strained early educators to retain challenging students without providing additional support and resources may not only contribute to rising teacher burnout rates but also lead to overall poorer quality childcare. Clearly, legislative bans against preschool expulsions without providing the support necessary for early educators to do something other than expel are insufficient (Zinsser et al., 2019). Sustainable and meaningful efforts to meet the crisis must address the financial pressures, resource deficiencies, lack of support, and mental health strains on early childcare professionals.

The provision of financial support for the childcare sector is key in relieving stress on educators. Recently, some countries have introduced funding supports for early childhood education. In the United Kingdom, the Early Years Alliance, a national charity that represents early childhood education providers, has welcomed the government's £1 billion funding package, but argues that more funding is needed to address the systemic underfunding of the sector (Early Years Alliance, 2021). The Alliance has called for sustained investment in the early years workforce, increased funding for free early education entitlements, and improved support for childcare providers. In France, the National Union of Family Associations (UNAF) has criticized the government's €7 billion funding package for early childhood education as inadequate to address the needs of children and families. It has called for increased investment in early childhood education and care, including support for parents and families, improved working conditions for childcare providers, and increased access to high-quality preschool programs. In the United States, the most recent federal support for early childhood education came in the form of the American Rescue Plan Act of 2021, which allocated $39 billion in funding for childcare and early education (NAEYC, 2021a). This funding has been used to support childcare professionals, increase access to affordable childcare, and expand early childhood education programs. Additionally, the Biden Administration's proposed infrastructure plan, the American Jobs Plan, included $225 billion for childcare and early education, including $200 billion for universal preschool for all 3- and 4-year-olds (NAEYC, 2021b).

Although these funding packages represent significant investments in early childhood education, many advocates argue that more funding is needed to fully address the lack of access to high-quality early childhood education and care, particularly for low-income families. While the packages act as life support for an industry in crisis, they fail to tackle the sweeping, systemic problems plaguing the industry (Zinsser et al., 2022). The early childhood education sector has been chronically underfunded for many years, leading to a lack of resources and support for families and educators (NAEYC, 2021a, b; Early Years Alliance, 2021; NUFA, 2021). Early childhood teachers are so poorly compensated that one in seven live in families below the poverty line, many receiving limited training (if any) and enduring poor working conditions (Zinsser et al., 2022). Low pay, a lack of recognition and respect, and insufficient resources take their toll on teachers and limit their ability to cope with students' challenging behavior. As fewer educators choose to enter a demanding and poorly compensated career in early childcare, increasingly unbalanced teacher-to-student ratios add to the pressure on existing programs. Passing bans on expulsion without further financial support for early childcare providers may exacerbate the issues policy makers are trying to solve (D'Souza, 2022).

However, additional funding is only one part of the solution. Teachers in preschools are charged with supporting children's social and emotional learning (SEL), such as self-awareness, self-management, relationship skills, and responsible decision-making. Research indicates that when teachers can make frequent use of SEL supports such as consultation from a mental

health professional, an in-class behavioral aide, and professional development opportunities, teacher stress and expulsion rates are reduced (Murano et al., 2020; Zinsser et al., 2019).

In addition to proactive SEL resource provision, early childhood mental health consultation (ECMHC) provides key reactive support when challenges arise. In December 2014, the US Department of Health and Human Services and the US Department of Education (2014) released a joint departmental statement extending support for ECMHC as an evidence-based approach to preventing expulsions and suspensions. ECMHC is a multilevel preventative intervention strategy teaming mental health professionals with early childhood education staff to improve young children's social-emotional and behavioral health and development. It aims to support children by fostering better child–teacher and teacher–family interactions. Childcare programs with access to ECMHC have reported half the rate of preschool expulsions compared to childcare programs without such access (Gilliam, 2005). Also, ECMHC has been associated with improved child–adult relationships and decreased teacher job stress, burnout, and turnover by identifying child concerns early and providing young children with the supports they need as soon as possible (Hepburn et al., 2013).

In Connecticut, the Early Childhood Partnership Program (ECCP), an ECMHC model studied in randomized controlled evaluations, was found to have positive effects on child behaviors (Gilliam et al., 2016a), with similar results replicated in a statewide randomized controlled evaluation in Ohio (Reyes & Gilliam, 2021). Additionally, positive behavioral interventions and supports (PBIS) have shown similar promising results. In a recent randomized controlled study, PBIS was shown to aid children in developing social skills and reducing challenging behavior (Hemmeter et al., 2016). However, despite such programs' promise, access for most teachers and classrooms remains limited. Further research is needed to determine whether such programs have long-term positive impacts on expulsion rates and reduce race and gender disparities.

Summary and Key Points

As we emerge from a global pandemic and begin to rebuild, it is vital that we recognize the dedication and sacrifice of those who carried us through. Early childcare professionals have provided essential support for families and frontline workers, caring for thousands of children across the country despite financial burdens and the risk of infection.

The epidemic of early childhood expulsions is a symptom of an industry in crisis. Under-resourced teachers pushed to their limits through Covid-19 must balance daily the needs of individuals against the needs of a classroom. Teachers are more likely to be pushed to an expulsion decision when faced with insufficient resources and supports. The severe effects of these choices are felt most acutely by young boys and those from marginalized communities who may, in some cases, be expelled for actions that are likely more a plea for support than cause for rejection from their school support base.

Mental health plays a crucial role in determining how capable a teacher feels in dealing with a child's challenging behaviors. As frontline workers, early childcare professionals have been put under extreme physical and mental pressure without access to many of the supports offered to other essential service workers. Children in early childhood care, too, have experienced during the Covid-19 pandemic a time of intense stress, with many losing loved ones or being exposed to increasingly strained home environments. The most vulnerable children, exposed to adverse experiences, especially when coming from marginalized and economically pressured communities, are also those who are at heightened risk of losing their chance to grow and learn in a supportive early childhood care and education environment. The epidemic of preschool expulsions is an avoidable tragedy. It is vital that we act now to provide funding for mental health resources and supports, relieving pressure on the strained early childcare sector. Financial support is crucial in allowing childcare programs to continue their postpandemic work and recovery. In the words of a frustrated educator stated on social media

during the pandemic: "why are childcare programs…not important enough to get adequate funding, but too important to close?" (Friendly & Ballantyne, 2020). Mental health support is vital. ECMHC and PBIS, while shown to be effective and cost-efficient, are difficult to access for many childcare professionals who urgently need these supports.

Support for our children and teachers is now more important than ever. Equal opportunity and access have long been cherished ideals in America, ideals never fully realized. While early childhood education has been envisioned as a way of closing inequality gaps and remedying social injustices, at present, it is under untenable strain. Without essential lifelines, we risk placing educators under further unsustainable pressure, leading to continued, if not increasing, rates of preschool expulsions and the resulting lost developmental opportunities for young children.

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Part II

Neurobiological Influences

8 Overview: Neurobiological Systems and the Psychobiology of Enactive Intersubjectivity

Hiram E. Fitzgerald

In the early part of the twentieth century, Adolph Meyer, a Swiss neurologist/psychiatrist coined the term, psychobiology, to express his view that mental illness was better studied and treated as maladaptive behavior rather than as diseases of the brain. Just as Bowlby (1969) integrated theory and research from multiple disciplines (ethology, psychoanalysis, information theory, and cognitive psychology) and developed his profoundly influential theory of attachment, Meyer's integration of evolutionary biology, philosophy (pragmatism), and neurology transformed psychiatry, from emphasis on a disease model of mental health, to one that emphasized "subjective experience and social behavior [as] *functions* of human biology—causal agents, not inert side effects, in the human organism's interaction with its environment." (Lamb, 2015, p. 445). By emphasizing a systemic approach to the science and practice of psychiatry within the context of evolutionary biology and pragmatic philosophy, Meyer not only transformed psychiatry, but also he pre-dated the emergence of dynamic systems theory's (Overton, 2015) and evolutionary psychology's emphasis on adaptive phenotypes resulting from organism-environment transactions over the life course (del Guidice & Ellis, 2016). Meyer conceptualized the brain as serving the same function ascribed to it by Ammaniti and Trentini (Chap. 15); providing for the integration of the organism's sensory and motor experience and adaptive processing. Meyer's concept of social adaptation is inclusive of all biopsychosocial actions of the individual from a dynamic systems framework. Moreover, he emphasized that each individual constructs a unique pathway to identity development (self) and to what we refer to today as mentalization (understanding the synchrony between our thoughts and those of others) (See Lamb, 2015).

With this background in mind, and with the theoretical origins of infant mental infant described in Chap. 1, we now turn to basic research involving the biological system components of social-emotional development. In each chapter, the authors point to the quality of organism-environment transactions that affect the balance of risk-resilient life course experiences that impact phenotypic development, beginning in the prenatal period. We have drawn attention to many of the postnatal infant-generated organizers that prompt reciprocal positive social and emotional reactions from caregivers. When such organizers are responded to appropriately and contingently, the infant's life course shifts the resilience side of the continuum (see Fig. 8.1). When responses are adverse, the infant's life course shifts toward the risk side of the continuum. As the infant's life course proceeds, the extent to which initial phenotypic

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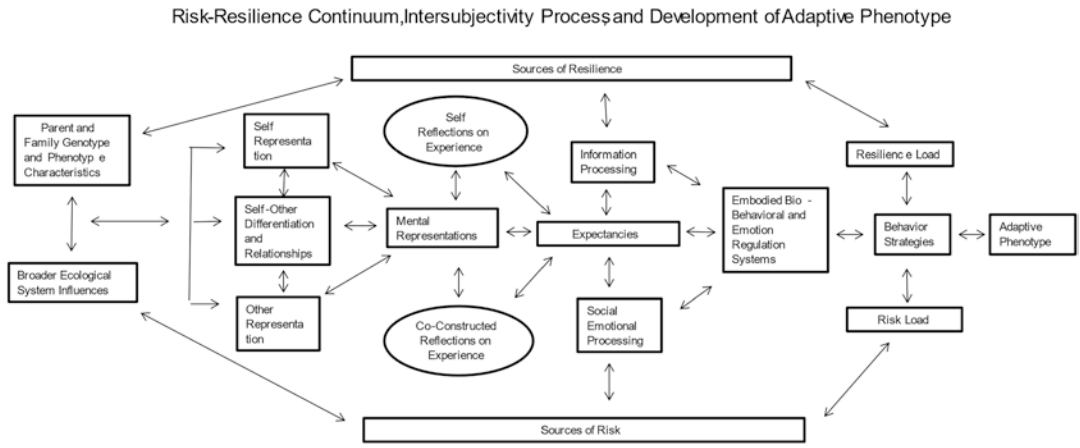

Fig. 8.1 Risk-resilience continuum, intersubjectivity process, and development of adaptive phenotype

pathways continue will be determined by their lived experiences, the adaptations effected by those experiences, and the risk–resilience balance. Throughout the pregnancy to postnatal age 5, much of the initial foundational aspects of the phenotype are organized.

The key focus of the chapters in Part II is on the epigenetic, neurobiological, and neuroendocrinological systems involved in mediating or moderating the individual's phenotypic characteristics as they become embodied, becoming a part of what Meyer described as "a single adaptive response of the human organism" (Lamb, 2015, p. 446); that is, the adaptive response of a system. The infant and young child's response to stress is a common theme across the chapters. It is easy to think of stress as something that is specific to the individual. But from a systems perspective, that is only half of the story. Stress often involves others, and in the case of infants, the others most commonly are caregivers who attempt to relieve the infant's stress. Another way to think about reactions to stress is that such reactions typically provoke others to provide comfort and/or to become equally stressed. In their stress general model, Rnic et al. (2023) draw attention to dependent and independent categories of stress. Dependent stress is linked to behaviors that the individual chooses to do; it is goal directed. A toddler screaming and crying while in her crib or playpen to get a caregiver's attention is an example of dependent stress. The toddler initiated the action to achieve an outcome. Living in endemic poverty with minimal food availability, experiencing natural disasters such as hurricanes, or human created disasters such as war, creates stress that is the result of events independent of the infant's intentional action, of that of their caregivers as well. The key point is that caregiver responses to the infant will differ depending on whether the stress source is dependent or independent, and the extent to which the caregiver may be stressed as well.

In Chap. 9, Champagne, Dusajh, and Firestein review research on changes in gene expression effected by its adaptations to the environment beginning during the prenatal period and perhaps at conception, via pre-conception epigenetic changes in ovum or sperm (Day et al., 2016; Mashoodh et al., 2018). During pregnancy, stress is predominately related to the mother's life course experiences, via her behavioral choices, or via difficult relationships with her adult partner. Champagne et al. discuss the possible epigenetic changes in gene expression that can affect the fetal uterine environment and overall birthing experience, as well as phenotypic characteristics that may impact the infant's postnatal relationship experiences.

Because prenatal events may produce phenotypic characteristics that affect relationships with others, it is important to determine such characteristics as early after birth as possible, especially for infants who require time in a neonatal

intensive care unit (NICU). In Chap. 10, Lester et al. describe the NICU Network Neurobehavior Scale (NNNS), designed to identify infants whose prenatal experiences place them at risk for subsequent problems. The NNNS involves assessment of both infant and caregiver so that prevention/intervention programs can be implemented as early as possible. Use of the NNNS enables identification of phenotypic profiles that lead to individualized interventions for infants and caregivers, designed to minimize risks and to strengthen resilience, throughout the birth to five postnatal period and often beyond.

The risk–resilience continuum metaphorically can be thought of as a seesaw such that when stressed one is on the downside of the seesaw, and when one is not stressed, one is on the high side. Sometimes stress is in-the-moment and readily relieved by caregiver action, and sometimes stress is chronic. Infant crying related to wanting a diaper change, being hungry, or wanting to play creates a stress situation for which relief is easily provided by caregiver action. But infant crying related to colic creates a stress situation for both infant and caregiver that is much more difficult to resolve (Lester & Grace, 2006) because it may lead caregivers to make poor decisions about how to quiet the infant, such as shaking the baby and possibly causing more severe problems, including death. Another example involves infant social withdrawal behavior, whether in response to the approach of a stranger, or being in a strange place, being overstimulated, or when severely deprived of social relationships (King et al., 2003). Viaux-Savelon et al. (2022) build upon Spitz' descriptions of infants raised in deprived environments, to include a wider range of neglectful contexts that lead to the pathological side of social withdrawal, which they refer to as Infant Sustained Social Withdrawal Behavior (ISSWB). Beyond profound negative effects on social-emotional development during infancy and early childhood, ISSWB is associated with long-term difficulties, including expressing empathy, self-other relationship intimacy, and mentalization. In Chap. 11, Kolacz and Porges describe the Polyvagal Theory (Porges, 2011), which describes the role of the autonomic nervous system in regulating stress via the social regulation of infant–caregiver transactions. Polyvagal theory posits that when stress is low, the parasympathetic nervous system acts to slow heart rate with associated positive infant–caregiver interactions. However, when environmental conditions produce stress, the sympathetic nervous system mobilizes actions along the fight or flight continuum exacerbating stress related behaviors. When the infant's environments are safe, activation of the vagus nerve slows heart rate and provides the physiological basis for generation of a sense of safety and comfort. However, when environments are not perceived to be safe, then vagal tone decreases, and the sympathetic nervous system mobilizes the individual to action. When caregivers respond to decreased stress, they help to strengthen attunement and enhance the quality of co-regulation of stress effects and the infant's development of affiliative social learning (Rattaz et al., 2023).

The co-regulation of stress responsivity during infancy and early childhood is not restricted to the actions of the autonomic nervous system, but to the mobilization of all physiological systems that contribute to allostasis (homeostasis or stable physiological systems related to stress; McEwen, 2000). In Chap. 12, Atkinson et al. explore the rich diversity in systemic physiological responses to stressful maternal–child relationships within the context of maternal depression. Focusing on the integrative relationships among 3 dimensions of allostatic process—flexibility, attunement, and coordination—they describe the rich variability in responses to risk, including times when high coordination in dimensions of allostatic load may lead to unanticipated detrimental effects when confronting threats and involvement of the hypothalamic–pituitary–adrenal emotion regulating system. Their studies using cortisol as an index of stress response point to a fascinating diversity of outcomes when including broader systems components than is typical in research focused only on dyadic relationships and single measures of physiological reactivity.

Technological advances in neuroimaging brings the brain itself into the domain of

observable characteristics of the phenotype through use of magnetic resonance imaging (MRI; Spann et al., 2023), functional MRI (Ellis & Turk-Browne, 2018), electroencephalogram (EEG: Hervé et al., 2022), and functional near-infrared spectroscopy (fNIRS: Gervain et al., 2023) to study brain structure and function in infants and very young children and their caregivers. By the end of the first year of life, infants evidence the ability to respond empathically to a caregiver's emotional state (Liu et al., 2022), providing early evidence that during the first year the infant's affiliative relationships to their caregivers reflect the embodiment of the caregivers biological and behavioral affiliative exchanges during their dynamic interactions. The synchronization of the physiological and behavioral components of affective behavior that occurs during infancy (Feldman, 2012) also includes structures and functions of the brain. In Chap. 13, Swain et al. review neuroimaging evidence of the brain's adaptive reactions to caregiver–infant transactions involving risk and resilient experiences. Importantly, they provide evidence that neuroimaging can be used to determine whether intervention programs such as Attachment Biobehavioral Catch-up and Mom Power lead to changes in brain function related to enhancing maternal empathy, stress regulation, and reflective functioning. In addition, recording mother and infant brain activity simultaneously (hyperscanning) provides an opportunity to observe the infant's brain reactivity and caregiver brain activity in real time.

Key themes cutting across the chapters in Part I and Part II of this Handbook stress the active, dynamic, systemic, organizational, integrative, and embodied aspects of the infant's engagement with others and the risk and resilience producing experiences to which the infant is exposed. Existentialism posits that existence precedes essence, and thus far in this volume we have focused primarily on issues about existence (I am). The final chapter in this part of the Handbook shifts attention to essence (Who am I). In Chap. 14, Ammaniti and Trentini describe the ontogeny of intersubjectivity from infancy through the toddler years, drawing attention to the infant–parent transactions that facilitate differentiation of self and other, and enable the young child to eventually be able to understand the subjective experiences of others. Intersubjectivity is tied to dynamic active engagements with experience (Fuchs & De Jaegher, 2009) that facilitate the development of autonomy, and participatory sense-making (De Jaegher & Di Paolo, 2007). Ammaniti and Trentini illustrate that as the forms of intersubjectivity become increasingly more complex, so does the infant's ability to recognize the intentions and affective states of another's mind and attune to their subjective experiences, thereby contributing to their construction of a theory of mind (Ruffman, 2023).

In the United States, the newly created HEALthy Brain Child Development (HBCD) national study involving 7500 families will study individual and family development beginning during pregnancy and continuing through childhood. It will focus on individual and family system dynamics as well as ecological influences on development, as evidenced by a vast variety of biomarker, neuroimage, behavioral, and ecological assessments allowing for cross-sectional glimpses of factors influencing both the genotype (epigenetics) and phenotype in-the-moment, as well as changes that occur over time that affect the risk–resilience balance as individuals adapt and calibrate their phenotypes (Croff et al., 2020; Morris et al., 2020). The implications for infant mental health practitioners are extraordinary. Being versed in research in infant social-emotional and cognitive development, and the neurobiological and brain organizational processes affected by lived experiences, both inform and challenge prevention and intervention programs, trauma-informed care, and public health programs designed to enhance the quality of life from prenatal development through early childhood.

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9 Epigenetic Mechanisms Linking Prenatal Maternal Stress to Developmental Outcomes in Infants and Children

Frances A. Champagne, Laura H. Dosanjh, and Morgan Firestein

Introduction

Epigenetic mechanisms have emerged as a critical biological interface between genes and the environment that accounts for both developmental plasticity and the lasting impacts of early life experiences (Meaney, 2010). During the prenatal period, there are dynamic molecular and neurobiological changes that shape the fetal and infant brain and predict neurobehavioral outcomes (Glynn & Sandman, 2011; Miller et al., 2014). At a molecular level, changes in gene expression are regulated through multiple factors, including epigenetic mechanisms. These epigenetic mechanisms include molecular modifications either directly to DNA (i.e. DNA methylation) or to surrounding proteins and gene transcripts (i.e. histone modifications, noncoding RNAs) (Jenuwein & Allis, 2001; Razin, 1998; Sato et al., 2011). DNA methylation has been explored extensively, due to the role of this chemical modification in gene silencing and due to the plasticity of this epigenetic mechanism in response to a broad range of experiences. The emerging literature within this field suggests that DNA methylation can shape developmental trajectories particularly in response to experiences that occur in early life (Szyf & Bick, 2013). Though plasticity in DNA methylation can be observed across the lifespan, variation in DNA methylation in the fetus and infant may establish the foundation for neurobehavioral functioning that persists into childhood, adolescence, and adulthood.

Prenatal maternal stress has been established as a significant predictor of obstetric and developmental outcomes in humans (Liou et al., 2016; Preis et al., 2021). Though the causal role of prenatal maternal stress in shaping development has primarily been established in animal models, the parallel between these lab-based studies and epidemiological studies in humans is evident (Monk et al., 2012; Weinstock, 2008). Exploration of the mechanisms linking prenatal maternal stress to developmental outcomes is increasingly incorporating analyses of epigenetic mechanisms such as DNA methylation. In this chapter, we will explore this literature, with a particular focus on the placenta and the association between prenatal maternal stress and preterm birth. Though the factors contributing to maternal stress are vast and include the early life experiences of mothers, there are potential interventions during the post-

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natal period that may interrupt the intergenerational transmission of prenatal maternal stress. Understanding of epigenetic mechanisms within this context may generate novel approaches to fostering healthy development in infants and children.

Epidemiological Studies Exploring the Impact of Prenatal Maternal Stress

Maternal exposure to psychosocial stressors before and during pregnancy increases the risk for suboptimal birth and infant outcomes (Ding et al., 2021; Lima et al., 2018). A recent meta-analysis of studies published in the United States, Europe, Asia, Africa, and Australia found that prenatal stressful life events were associated with a 20% higher risk of preterm birth, 23% increased risk for low birth weight, and 14% higher risk of babies being born small for gestational age (Ding et al., 2021). In addition, maternal prenatal stress has been associated with obstetric complications, spontaneous abortion, delayed intrauterine growth, heightened infant stress responsivity, and delayed motor and cognitive development (Bussières et al., 2015; Davis & Narayan, 2020; Wainstock et al., 2013; Weinstock, 2008). Within this literature, the type of maternal stressors associated with fetal and infant outcomes is broad and includes exposure to intimate partner violence, poverty, racism, discrimination, insecure housing, incarceration, natural disaster or other trauma, death of a family member, and mental health problems, including depression, anxiety, and post-traumatic stress disorder (PTSD) (Blumenshine et al., 2010; Collaer & Hines, 1995; Cutts et al., 2015; Ding et al., 2021; Laelago et al., 2017; Liou et al., 2016; Liu & Glynn, 2022; Menclova & Stillman, 2020).

Though explorations of the impact of prenatal maternal stress have focussed primarily on stressors occurring during gestation, there is also evidence that the lifetime stress of mothers, particularly stressors occurring in early life, can impact birth outcomes (Kern et al., 2022; Souch et al., 2022). The impact of childhood adversity on birth outcomes has been investigated through analyses of single forms of adversity such as sexual abuse or through a limited range of types of adversity. These studies have demonstrated mixed findings in relation to birth outcomes. For example, Wosu et al. (2015) surveyed research examining the relationship between childhood sexual abuse (CSA) and preterm birth. Only 50% of their final sample demonstrated that CSA had a statistically significant effect on the odds of preterm birth (Wosu et al., 2015). In a sample of female nurses, analyses of the relationship between type, timing, and severity of maltreatment (sexual abuse, physical abuse, and harsh parenting) on preterm birth found that that forced sexual activity in childhood or adolescence was linked to a 22% increase in odds of preterm birth (Selk et al., 2016).

The impact of childhood adversity on birth outcomes has also been examined through the Adverse Childhood Experiences (ACEs) model (Christiaens et al., 2015; Hemady et al., 2022; Kern et al., 2022; Mersky & Lee, 2019). The ACEs screen captures several types of adversity and creates a total score based on the number of adversity categories reported. The ACE score includes direct forms of maltreatment such as physical abuse, sexual abuse, verbal abuse, physical neglect, and emotional neglect in addition to several categories of household dysfunction such as parental divorce, incarceration of a parent, parental mental illness, substance use in the home, and domestic violence (Felitti et al., 1998). It has been suggested that because forms of maltreatment often co-occur (i.e. individuals exposed to one form of maltreatment are more likely to be exposed to additional types of maltreatment), results from studies measuring only singular types of maltreatment may be limited by the confounding (albeit unmeasured) effects of other adversities (Dong et al., 2004; McLaughlin et al., 2020). For this reason, it has been asserted that the ACEs model supports a more thorough assessment of the impact of ACEs on numerous outcomes across the lifespan (Hamby et al., 2021). Consistent with this assertion, studies examining birth outcomes using an assessment of total ACEs have shown more consistent results.

In a recent systematic review, studies investigating the link between total ACEs and preterm birth were surveyed with seven of nine studies demonstrating a significant effect of ACEs on preterm birth (Sulaiman et al., 2021).

Psychological, Behavioral, and Social Risk Factors Linking Early Life Stress and Infant Outcomes

Early life adversity has been associated with many prenatal stressors that are linked to suboptimal birth and infant outcomes, such as prenatal depression, anxiety, and PTSD (Davis & Narayan, 2020). For example, a study with a sample of 636 pregnant women found that participants with four or more ACEs had a 2.5-fold increase in the odds of prenatal depression (Wajid et al., 2020). Similarly, a study of low-income racially diverse pregnant women found that the total number of ACEs predicted elevated levels of depressive and PTSD symptoms (Atzl et al., 2019). In a recent study, a dose–response relationship was found between the total number of ACEs and the odds of prenatal depression and anxiety (Racine et al., 2022). Taken together, these studies demonstrate the wide-ranging psychological impacts of childhood adversity across the lifespan. While these experiences affect maternal psychological well-being during pregnancy, they also affect the development of the fetus and subsequent infant outcomes. Maternal depression and anxiety have been associated with preterm birth as well as delayed social-emotional, cognitive, language, motor, and self-regulation skills in infants and children (Rogers et al., 2020; Staneva et al., 2015). A recent systematic review and meta-analysis demonstrated that prenatal maternal PTSD is associated with increased risk of low birth weight, preterm birth, and gestational age (Sanjuan et al., 2021). Maternal PTSD has further been associated with delayed fine motor and adaptive behavior development in infants (Koen et al., 2017).

Childhood adversity has also been associated with maternal health risk behaviors and exposure to current life stressors during pregnancy. Early adversity has been linked to higher rates of substance use and smoking during pregnancy, which may mediate the effects of adversity on birth and infant outcomes (Chung et al., 2010; Davis & Narayan, 2020; Smith et al., 2016). While ACEs are associated with risky health behaviours, they are also associated with life circumstances that increase risk for poor fetal and infant outcomes. Early childhood adversity in mothers is associated with exposure to traumatic and stressful life events such as intimate partner violence (IPV), exposure to neighborhood violence, and food insecurity (Buehler et al., 2022; Castro et al., 2003; Mahenge et al., 2018). IPV has been associated with low birth weight and preterm birth (Hill et al., 2016; Laelago et al., 2017) as well as increased odds of language delay in toddlers (Udo et al., 2016).

Biological Mechanisms Impacted by Prenatal Stress

Maternal exposure to stress, such as the experience of early childhood adversity, has neurobiological consequences that are transmitted to the fetus during pregnancy resulting in the intergenerational transmission of adversity (Davis & Narayan, 2020) though disruption to neural, endocrine, immune, and metabolic physiology (Deighton et al., 2018). In particular, the experience of chronic stress in childhood can impact the function of the hypothalamic–pituitary–adrenal (HPA) axis resulting in long term hyper- or hyporeactivity of the sympathetic and parasympathetic branches of the nervous system. This dysregulation may manifest in abnormal peripheral and central glucocorticoid activity, reduced or unmodulated immune function, and increased inflammatory markers (Berens et al., 2017; Deighton et al., 2018). During gestation, the HPA axis and placenta form a feedback loop that stimulates production of corticotropin releasing hormone (CRH) from the placenta. The maternal HPA and placental axis plays a vital role in the process of fetal maturation and timing of delivery and it has been demonstrated that early life adver-

sity of mothers is associated with elevated CRH levels during pregnancy (Moog et al., 2016). Elevated levels of maternal placental CRH (pCRH) in late pregnancy have been associated with early life adversity of mothers (Steine et al., 2020). Elevated pCRH during pregnancy has also been linked to preterm birth (Lee, 2014), fetal growth restriction (Wadhwa et al., 2004), and maternal psychiatric and medical outcomes such as postpartum depression, preeclampsia, and pregnancy-induced hypertension (Glynn & Sandman, 2014; Laatikainen et al., 1991). Long-term consequences of elevated pCRH on the development of infants and children include heightened levels of fear and distress, depression, anxiety, and externalizing symptoms (Davis et al., 2005; Howland et al., 2016). Thus, the HPA axis and placenta serve as a critical pathway linking maternal childhood adversity to intergenerational outcomes.

Placental Regulation of Stress Transmission and Exposure

The role of the placenta in regulating the transfer of nutrients and waste between the mother and fetus has long been recognized as a critical process for healthy fetal development (Burton & Jauniaux, 2015; Godfrey & Barker, 2001). In recent decades, more nuanced functions of the placenta, such as epigenetic and hormonal responses to environmental factors have become the focus of emerging areas of research (Shallie & Naicker, 2019). The placenta is a temporary endocrine organ that plays a critical role in regulating the hormonal milieu of the mother, the fetus, and the intrauterine environment more broadly. Early in embryonic development, the blastocyst forms and is composed of two primary layers, the inner cell mass, which will develop into the fetus, and the trophoblast, which will form the placenta, emphasizing the genetic overlap between the fetus and the placenta (Boss et al., 2018). As the trophoblast continues to develop, mononuclear cytotrophoblast cells fuse together and form the highly specialized syncytiotrophoblast cells, which are responsible for the production, synthesis, regulation, and transfer of many hormones between mother and fetus (Gore et al., 2014; Gude et al., 2004; Kliman et al., 1986, 2021). Notably, the placenta has the potential to modulate the synthesis and transfer of maternal hormones, such as glucocorticoids and androgens, which in turn may impact maternal mood and behavior, fetal brain development, and the quality of mother–infant interactions postnatally (Firestein et al., 2022; Gore et al., 2014; Jensen Peña et al., 2012; Mann & Bridges, 2001; Monk et al., 2012, 2016; Siiteri & MacDonald, 1966). Placental function as an interface between mother and fetus is dependent on transcriptional changes that are regulated by epigenetic mechanisms (Maltepe et al., 2010; Novakovic & Saffery, 2012).

To further understand the intergenerational transmission of stress and impacts on fetal and infant development, two primary epigenetic mechanisms within the placenta have been investigated: differential DNA methylation (gene-specific and genome-wide) and epigenetic aging.

Placental Epigenetic Modifications Associated with Prenatal Maternal Stress

Research spanning human and nonhuman species has evaluated the role of epigenetic modifications to specific genes, especially those within the HPA axis, in the relationship between exposure to prenatal stress and offspring behavioral outcomes (Monk et al., 2012). Prenatal maternal stress is associated with changes in DNA methylation and expression of corticosteroid 11-beta-dehydrogenase 2 (*11β-HSD2*) in both human (Capron et al., 2018; Conradt et al., 2013; Monk et al., 2016) and rodent (Jensen Peña et al., 2012) placentas. This gene is of particular interest as it encodes the 11β-hydroxysteroid dehydrogenase 2 enzyme, which converts cortisol into the biologically inactive cortisone and is highly expressed in placental tissue (Bronson & Bale, 2016; Limumpornpetch & Stewart, 2019; Monk et al., 2012). Interestingly, perceived psychological distress in humans has been found to be more

strongly associated with changes in DNA methylation of *11β-HSD2* than direct measures of maternal cortisol (Monk et al., 2016). Maternal depression occurring in early pregnancy is associated with broad changes in DNA methylation within the placenta, particularly within genes that regulate neural development (Lund et al., 2021). Further, *11β-HSD2* methylation within the placenta has been found to moderate the association between prenatal maternal depression and infant cortisol levels (Stroud et al., 2016) and reduced expression of this enzyme in the placentas of women who were depressed during pregnancy results in elevated fetal cortisol exposure (Nemoda & Szyf, 2017). Socioeconomic stress during pregnancy is associated with low levels of placental DNA methylation within *11β-HSD2*, particularly within the male placenta (Appleton et al., 2013). Exposure to chronic stress or trauma during pregnancy has been associated with altered placental DNA methylation in several genes within the HPA axis, particularly at transcription factor binding sites, which may be predictive of low birth weight (Kertes et al., 2016). Differential methylation of HPA axis genes within the placenta, particularly *NR3C1*, is associated with greater infant cortisol reactivity and self-regulation, suggesting prenatal epigenetic programming of infant development (Conradt et al., 2015).

Prenatal Stress Impacts on Epigenetic Aging

DNA methylation-based (DNAm) age estimators have emerged, which may provide insight into the impact of stress on biological aging (Horvath & Raj, 2018). These DNAm age estimators, or 'DNAm age' measures, have a robust linear relationship with chronological age and DNAm age, even in pediatric populations where infant gestational age at birth (in weeks) and DNAm age correlations are assessed using cord blood or blood spots at birth (Knight et al., 2016; McGill et al., 2022). Despite the overall linear relationship, DNAm age can exceed chronological age, a state referred to as DNAm age acceleration or epigenetic age acceleration (Simpson & Chandra, 2021). It has been proposed that this biological aging acceleration is the consequence of lifetime stress burden and may reflect the process by which this burden impacts physical health (Jain et al., 2022; Roetker et al., 2018). This process may also have intergenerational consequences. For example, elevated maternal anxiety during pregnancy is associated with greater DNAm age acceleration in children at 6–10 years of age, especially among male children (McGill et al., 2022). Epigenetic age acceleration is also associated with childhood adversity, which may then impact maternal mental health during pregnancy as well as infant development (McKenna et al., 2022; Rampersaud et al., 2022). While epigenetic age acceleration may reflect greater exposure to stress in utero, it may also confer protective benefits to the preterm neonate. Among extremely preterm infants, those with heightened epigenetic age acceleration were less likely to require surfactant or postnatal corticosteroid treatment for lung immaturity, required fewer days of assisted ventilation, and were less likely to be diagnosed with bronchopulmonary dysplasia (Knight et al., 2018).

Epigenetic Variation in Preterm Birth

The prenatal adversity that may emerge as a consequence of maternal stress can result in further intrauterine and gestational complications leading to premature birth. Preterm birth includes any delivery that occurs prior to 37 weeks gestational age and accounts for approximately 10% of all births in the United States (Frey & Klebanoff, 2016) with global estimates ranging from 8.7% to 13.4% of births (Chawanpaiboon et al., 2019). Infants who are born preterm are at increased risk for neurodevelopmental conditions, including autism, attention-deficit/hyperactivity disorder, language delays, and deficits in executive function and other cognitive domains (Welch et al., 2015), with risk modulated by a broad range of variables, including gestational age at birth, birth weight, childhood adversity, and sociodemo-

graphic variables (Hee Chung et al., 2020). Several gestational factors have been implicated in the etiology of premature delivery and it is generally categorized into three subtypes: medically indicated preterm birth, spontaneous onset of labor resulting in preterm birth, and preterm premature rupture of membranes resulting in preterm birth (PPROM) (Frey & Klebanoff, 2016; Goldenberg et al., 2012; Horta et al., 1997). Elevated DNA methylation has been found in postpartum blood samples of mothers who deliver preterm vs. term in the cytohesin 1 interacting protein *(CYTIP)* gene, which is normally highly expressed in the myometrium during labor (Hong et al., 2017). The presence of risk factors for preterm birth may be important considerations in predicting the epigenetic profiles associated with this outcome. For example, many pregnancies that result in preterm birth are complicated by preeclampsia, a gestational condition leading to maternal hypertension that is thought to arise due to inadequate formation of the spiral arteries of the placenta (Herzog et al., 2017; Perez-Sepulveda et al., 2015). In cases of early-onset preeclampsia compared to spontaneous preterm birth, there are thousands of differentially methylated sites within the genome of white blood cells from the umbilical cord blood and the placenta (Herzog et al., 2017). Compared to healthy controls, only placentas from cases of early-onset preeclampsia differ epigenetically. These findings suggest that infants who are delivered prematurely due to preeclampsia may experience epigenetic programming that differs from that of infants who are born preterm for other reasons such as PPROM or an intrauterine infection.

Altered DNA methylation within genes in the placenta have been observed in cases of preterm birth. A large meta-analysis reported that several genes (*UNC, OXTR, DLLI, RUNX*) are hypomethylated in placentas of preterm infants (Toure et al., 2017). This hypomethylation is even more pronounced in male placentas, which may be linked with the male bias in the incidence of preterm births (Martin et al., 2017). Using data from the extremely low gestational age newborns study (ELGANS) cohort, 2745 genomic sites from 578 genes were found to be differentially methylated between male and female placentas (Santos et al., 2019). All but 13 genes were located on the X-chromosome and were hypermethylated in male placentas compared to female placentas. Genes within the major histocompatibility complex, a genomic region critical for immune reactivity, tend to be hypomethylated in women who deliver prematurely and increased expression of immune factors could result in maternal rejection of the fetus (Ribeiro de Andrade Ramos & da Silva, 2017). Taken together, these findings suggest that there may be sex-specific susceptibility to environmental insults that could result in further alterations to fetal and maternal immune responses during pregnancy that could shorten the length of gestation.

During the postnatal period, differential DNA methylation in infants has been found associated with preterm birth and this epigenetic variation is predictive of neurobehavioral outcomes. Both hypomethylation and hypermethylation have been observed in the *NR3C1* gene in saliva samples from preterm infants compared to full-term infants (Kantake et al., 2014). These epigenetic effects are influenced by several factors, including intrauterine growth, mode of delivery, and the infants' Apgar scores at 1 minute after delivery. Hypermethylation of the *NR3C1* gene is associated with poor neurodevelopmental outcomes as measured by the NICU Network Neurobehavioral Scale (NNNs) (Lester et al., 2014, 2015). Specifically, hypermethylation of the *NR3C1* gene in placentas of preterm infants was inversely correlated with the quality of physical movements and attention to external social and nonsocial stimuli. Similarly, increased DNA methylation of the *SLC6A4* gene in neonates is associated with a shortened duration of orienting toward social stimuli (Montirosso et al., 2016). Seven year-old children who were born preterm exhibit increased DNA methylation of the *SLC6A4* gene in salivary samples that is associated with behavioral difficulties in mid-childhood, suggesting that the epigenetic effects of preterm birth persist well beyond NICU discharge (Chau et al., 2014). Finally, hypomethylation of the

IGF2 antisense transcript (*IGF2AS)* has been measured in blood samples from 18- to 27-year-old adults who were born prematurely at very low birth weights, which may account for lifespan health outcomes as a consequence of preterm birth (Wehkalampi et al., 2013).

Preterm Birth, Postnatal Adversity, and the Epigenome

Following exposure to the intrauterine and gestational complications that lead to premature birth, preterm infants are born into an environment for which their central and autonomic nervous systems are not yet prepared. The environment of the neonatal intensive care unit (NICU) may be particularly adverse for the developing preterm infant (Provenzi et al., 2017). During NICU hospitalization, infants are exposed to sensory stimulation that is qualitatively different than what they would ordinarily be exposed to in utero at that gestational time point. Given the relatively immature neurodevelopmental state of the preterm brain, these infants exhibit extreme sensitivity and reactivity to external stimuli, including routine NICU procedures like diaper changes, which have the potential to elicit a stress response (Spittle et al., 2016). Infants who are hospitalized in the NICU are also exposed to high levels of pain and discomfort as part of standard NICU care. In a sample of 137 preterm infants, the average number of skin-breaking procedures during NICU stay was 121 (Grunau et al., 2009). Critically, infants who were neonatally exposed to a greater number of painful procedures had poorer neurodevelopmental functioning during toddlerhood (Grunau et al., 2009). Moreover, DNA methylation within the *SLC6A4* gene increases significantly from birth to NICU discharge in preterm infants who are classified as having had high-pain exposure while hospitalized (Provenzi et al., 2015). An additional consequence of NICU hospitalization is prolonged and repeated maternal separation and there is a substantial literature illustrating that interactions with caregivers can have profound and long-lasting effects on epigenetic, social, and emotional development of the offspring (Hane et al., 2015; Peña et al., 2013; Weaver et al., 2004).

Postnatal Interventions to Foster Healthy Development in Preterm Infants

In the NICU, several interventions, including Kangaroo Mother Care (KMC), the Newborn Individualized Developmental Care and Assessment Program (NIDCAP), and Family Nurture Intervention (FNI), have been implemented with the goal of improving the health and neurodevelopment of preterm infants (Lawhon & Hedlund, 2008; Tessier et al., 2003; Welch et al., 2012). These interventions increase parental engagement with newborns, particularly though increased tactile interactions and skin-to-skin contact. At 1 year of age, preterm infants who received KMC have improved performance on personal–social, hearing and speech, and executive functioning tasks (Tessier et al., 2003). KMC is associated with accelerated brain maturation in neonates and long-term improvements in cerebral-motor functioning (Kaffashi et al., 2013; Schneider et al., 2012). Preterm infants within NIDCAP interventions have improved motor regulation and self-regulation scores, increased brain maturation and improved overall health relative to premature controls (Als et al., 2012). Preterm infants who receive FNI have improved cognitive and language scores, reduction in attention problems, decreased socioemotional problems resulting in reduced risk of autism, and similar to KMC and NIDCAP exhibit advanced brain maturation (Welch et al., 2015, 2017). FNI also has lasting effects on maternal mental health and maternal caregiving behavior, resulting in decreased maternal depression and anxiety as well as improved mother–infant face-to-face communication at 4 months of age (Beebe et al., 2018; Welch et al., 2016). Though the epigenetic impact of these interventions has yet to be elucidated, increased frequency of neonatal tactile stimulation is associated with global changes in DNA methylation and altered epigenetic age (Moore et al., 2017). Moreover, the increased

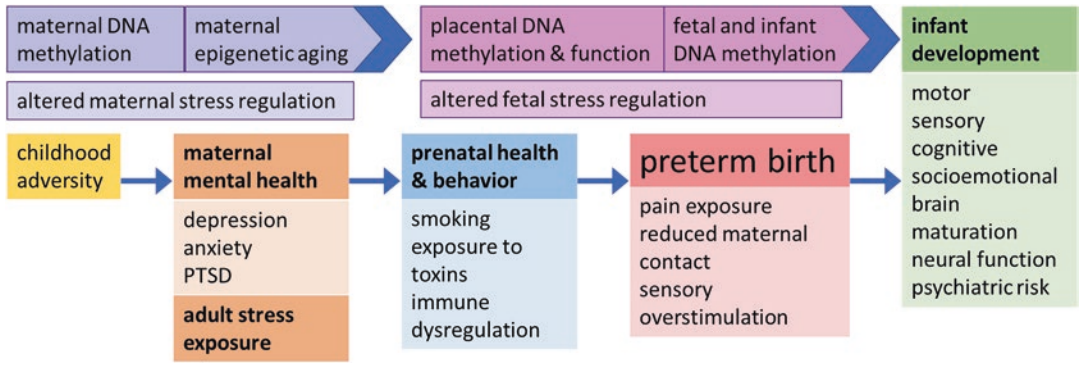

Fig. 9.1 Cascade of maternal experiences that are associated with mental health during pregnancy, risk behaviors, and stress exposure that contribute to prenatal maternal stress and risk of preterm birth. Preterm birth is associated with additional exposures that may confer vulnerability. Cumulatively, these experiences impact infant development via dysregulation of maternal and fetal stress systems, and altered DNA methylation in mothers, the placenta, and fetus

maternal responsivity associated with these interventions may lead to decreased DNA methylation of the *NR3C1* gene and more regulated stress responses in infants (Conradt et al., 2019).

Summary and Key Points

Prenatal stress is a reflection of the life experiences of mothers and can result in the intergenerational transmission of health risks. This transmission is characterized by a cascade of biobehavioral effects that impact the fetal environment, the timing of birth, and exposure to variation in the quality of the postnatal environment (see Fig. 9.1). Integration of analyses of epigenetic effects within this cascade reveals the critical importance of placental function, the multifaceted risk associated with preterm birth, and potential avenues for dynamic epigenetic and developmental change associated with postnatal interventions that focus on the experiences of mothers and infants. Though DNA methylation variation within genes that regulate the response to stress (i.e. *NR3C1*, *11β-HSD2*) and mood (i.e. *SLC6A4)* have emerged within this literature, broader epigenome-wide associations are increasingly apparent that suggest a global impact of stress and potential impacts on immune function and biological aging. Importantly, though DNA methylation is highly stable, the ability to target the plasticity of this mechanism and shift developmental trajectories is being increasingly explored. Future work in this field should continue to explore this plasticity and integrate this more dynamic notion of the epigenome within intergenerational studies. Understanding of this plasticity may also be enhanced through integration of emerging findings regarding the impact of pre-conceptional paternal stress on developmental trajectories and the interplay between maternal and paternal stress on gestation and the offspring epigenome (Day et al., 2016; Mashoodh et al., 2018).

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Newborn Neurobehavior and the Development of Infant Mental Health

10

Barry M. Lester, Elisabeth Conradt, and Ed Tronick

Our ability to accurately assess and evaluate the neurobehavioral integrity of the newborn and young infant is of critical importance for both research and clinical practice. It also has social policy implications because of the increasing number of infants born at risk, for example, due to preterm status or those with prenatal substance exposure, that need services. Infant assessment, historically, has been strongly influenced by the current dominant theoretical view of the infant and of the mind or brain. Prior to the turn of the twentieth century, the infant was viewed as diffusely organized, unstructured, and lacking in sensory capacities and motor abilities. No examinations existed because there was "nothing" to evaluate.

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History of Infant Assessment

At the turn of the twentieth century, infant functioning was associated with the model of reflexes developed by Sherrington (1906). Much of this work was based on studies of the spinal frog and the view that the single neuron was the fundamental unit of the nervous system. This model was elaborated by learning theorists who viewed the reflex, like the neuron, as the building block of behavior. During this period, Peiper (1928) began his exploration of the newborn's reflexes, eventually publishing a standard neurologic text on the newborn. Critical demonstrations of reflexes in anencephalic infants supported the idea that infants only operates at the spinal level.

Reflex models became supplemented by models of more generalized motor functioning. André-Thomas and Saint-Anne Dargassies (1952) developed an examination that focused on the motor tone of the infant in which tone involved passive and active components. They were influenced by models of the brain that were beginning to focus on mass action as enunciated by Lashley (1951) in the United States and models that included inhibitory and excitatory centers, concepts that would not be fully incorporated into thinking about infants for another 25 years. Critically, these conceptualizations led to the view that the infant was able to modulate behavior, not just act in an all-or-none reflexive fashion. Concepts of active and passive tone became

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part of the dominant view of infant assessment, and a model started to evolve into one of control or feedback systems, with the thermostat as the mechanical metaphor.

A major advance, by Prechtl (1974), was the introduction of the concept of infant state into newborn assessment. Descriptively, states were differentiated, structured organizations of the brain and associated physiology that affected how the infant responds to stimulation. Prechtl demonstrated that the same stimulus resulted in different responses in different states, introducing a substantive change in the view of the infant's neurobehavioral functioning. The brain, not just the spinal cord, was involved in the infant's responses, and more importantly, the infant's brain was active and affected how the infant reacted. The stimulus did not determine the response. When the state was considered, the neurobehavioral organization of the infant became more apparent. State, the organization of its components and their sequential organization over time became "assessable" features of the infant's neurological status. An intact brain was capable of organizing states, whereas a damaged brain could not. This advance was derived from early work on sleep and electroencephalogram (EEG) activity in which it was demonstrated that the brain is not simply quiescent when the organism is asleep, but shows differentiated states with different electrical, physiologic, and behavioral concomitants. Thus, even when asleep the brain was active. Prechtl's formulation of "state" decimated the reflex model of the infant.

Examination of the infant's neurological status became a feature of standard care. These examinations viewed the infant as active, responsible for generating the responses and modulating performance. Research demonstrated that even asphyxiated infants and anencephalic infants generated variable reflexes, that healthy infants modulated their responses, and that modulation and state-dependent responsiveness were characteristics of the infant. Simple S-R (stimulus-response classical conditioning) reflex models were no longer tenable – there was a brain in the baby, and the baby could no longer be seen as diffusely organized, unstructured, lacking in sensory capacities and motor abilities.

With the discovery of this new baby, starting in the 1950s and exploding into the 1960—1990', developmental researchers demonstrated highly complex functioning in the infant. Fantz, Fagan, and Miranga (1975) demonstrated preferential gaze, and much research followed showing that neonates were capable of complex, highly differentiated hand movements, discrimination of sounds, affective behaviors in response to stimuli, detection of odors, coordination of movement and speech, different cry patterns, and engagement in socially focused activities. As the competent infant arrived on the scene, it was also recognized that the infant had abilities to control (regulate) its own level of arousal, and to habituate, a rudimentary form of learning. The recognition of infant functional competence led to the development of assessments of these more complex forms of behavior. Rosenblith (1961) developed a scale that incorporated qualities of infant orientation and habituation, as well as tone and reflexes. Brazelton and colleagues (Brazelton, 1973) developed the groundbreaking Neonatal Behavioral Assessment Scale (NBAS), which included items focused on the infant's capacity to self-regulate and to interact with animate and inanimate stimuli. For the first time, Brazelton's NBAS saw and assessed the infant's social competence or at least the infant's competencies in a social context. With these advances and influences from the concept of temperament, the field of neurobehavioral assessment moved beyond the evaluation of neurological integrity and toward the assessment of individual differences. The NBAS focused on assessing the infant in a social context and emphasized how the infant's individual neurobehavioral differences affected caregiving and development.

Studies of normal infants raised questions about what might affect the expression of behavior of newborn infants. Brazelton and his colleagues pioneered studies of medical conditions (e.g., low birthweight; Als et al., 1976) that affected the infant's neurobehavioral organization. Thus, with its focus on individual differences and the factors that affect those differences,

as well as its conceptualization that these differences affect the caregiver's behavior and the infant long-term development, the NBAS became the dominant neonatal behavioral assessment in the field. Moreover, the use of the NBAS confirmed the emerging view that infant development was determined by a complex interactionist perspective.

Development of the NICU Network Neurobehavior Scale (NNNS)

The NNNS was developed by Lester and Tronick (2004) for the National Institute of Health (NIH) for the multisite "Maternal Lifestyle" longitudinal study of prenatal drug exposure and child outcome in term and preterm infants. The demands of this project required an examination that evaluated risk status and toxic exposures in a wide range of infants of varying birthweights, which could be reliably used at multiple sites. The exam needed to broadly assess the infant at risk, not just a single group, such as preterm infants or only drug-exposed infants, for two major reasons. First, most drug-exposed infants are term, not preterm infants. Second, prenatal drug exposure often occurs in the context of multiple risk factors. These factors may be biological, such as prematurity or intrauterine growth retardation, or social, such as poverty, poor nutrition, and lack of prenatal care, which also have biological consequences for the infant. Therefore, the exam needed to be sensitive to the many risk factors that affect infant neurobehavior and to assess a variety of domains of functional status. Moreover, there was a broader need for an examination that was standardized. The aim was to provide a comprehensive standardized, and reliable evaluation of the neurobehavioral performance of the high-risk infant during the perinatal period, inclusive of neurobehavioral organization, neurological reflexes, motor development, self and interactive regulatory capacities, active and passive tone, and signs of stress and withdrawal.

The NNNS draws on prior examinations in addition to the NBAS, including the Neurological Examination of the Full-term Newborn Infant (Prechtl & Beintema, 1964), the Neurological Examination of the Maturity of Newborn Infants (Amiel-Tisson, 1968), the Neurological Assessment of the Preterm Infant (NAPI; Korner & Thom, 1990), the Assessment of Preterm Infant Behavior (APIB; Als et al., 1982) and the Finnegan Neonatal Abstinence Scoring System (Finnegan, 1986). Use of the NNNS is not restricted to a particular type of infant (e.g., drug-exposed) or to a limited age (e.g., full-term or preterm), and it is used for a variety of infants and for infants of varying gestational ages.

The NNNS assesses and scores the full range of infant neurobehavioral performance; infant stress, abstinence and withdrawal, neurological functioning, and some features of gestational age assessment. Specifically, and procedurally, it evaluates behavioral states and frames the assessment of behaviors within states. The exam can be used with low and extremely high-risk infants once they are stable and into the postnatal period. It has a standardized administrative format that "removes" the examiner from the behavior assessed. The exam was designed to have internal validity and appropriate statistical properties and includes summary scores for the major domains of neurobehavioral performance, as well as stress and withdrawal. The summary scores can be converted to "profiles" that represent discrete subgroups of infants that have clinical significance. Finally, the NNNS was designed to be sensitive to the effects of a wide array of other risk conditions based on the empirical literature.

Neurobehavioral Basis of the NNNS

The term "neurobehavior" was originally developed to characterize the status of older children. It refers to an expanded neurological examination that involves sophisticated observation of higher cortical function and motor output that is often combined with an assessment of the maturation of the central nervous system or a search for minor neurological indicators. Here, the term is used broadly to reflect the idea that all human experiences have psychosocial, as well as biological or organic contexts. "Neurobehavioral"

recognizes bi-directionality – that biological and behavioral systems dynamically influence each other and that the quality of behavioral and physiological processes is dependent on neural feedback. Neurobehavior becomes the interface of behavior and physiology and includes neurophysiological mechanisms, such as epigenetics, that mediate specific behaviors or psychological processes. It emphasizes the plasticity of the nervous system. These processes are affected by multiple risk factors, and the NNNS was designed to measure processes of neurobehavioral organization determined by multiple risk factors. Since much of the neurobehavioral organization of the infant is determined by the combination of multiple biological and social risk factors, the exam must be sensitive to the broad range of behaviors that high-risk infants present.

The NNNS was designed to be generically sensitive to the range of behaviors that at-risk infants display and simultaneously attend to the specific dimensions affected by multiple risk factors. Psychometric characteristics of the exam (interrater reliability, test–retest reliability, construct validity, etc.) have been well established (Liu et al., 2010; McGowan et al., 2022).

Neurological integrity, tone and posture, behavior and signs of stress, and withdrawal are included to assess a variety of functional domains useful for assessing the range of high-risk infants' neurobehavior and are documented in the summary scores (Table 10.1). The summary scores can be used individually. They can also be converted into individual neurobehavioral profiles that show neurobehavioral patterns of performance across the exam at the individual child level. As such, profiles provide a whole child snapshot and are mutually exclusive, unique clinical neurobehavioral phenotypes. Profiles are computed using latent profile analysis in which profiles that make for the best model fit are evaluated using model fit criteria that include Bayesian information criteria, likelihood ratio test and the number of cases in each profile. Figure 10.1 is an example showing six profiles from a sample of preterm infants (McGowan et al., 2022). Profiles 5 and 6 are two groups of dysregulated infants. Profile 5 infants are hypo-dysregulated with low attention and arousal, more lethargy, hypotonia, and more nonoptimal reflexes. Profile 6 infants are hyper-dysregulated newborns who had low attention that required substantial handling, poor self-regulation, elevated arousal and excitability, hypertonia, poor quality of movement and more stress abstinence signs. As discussed later in this chapter, profiles 5 and 6 are clinically significant and have been shown to predict developmental outcome in several at-risk infant populations.

Table 10.1 NNNS summary scores

Attention	Ability to localize and track objects, faces, and voices
Handling	Handling strategies used during attention
Self-regulation	Organize behavior in response to stimulation
Arousal	Level of arousal during the examination
Excitability	High levels of motor, state, and physiologic reactivity
Lethargy	Low levels of motor, state, and physiologic reactivity
Hypertonicity	Hypertonic responses in arms, legs, trunk, or tone
Hypotonicity	Hypotonic response in arms, legs, trunk, or tone
Nonoptimal reflexes	Number of poor reflex scores
Asymmetric reflexes	Number of asymmetric reflex scores
Quality of movement	Smoothness, maturity, lack of startles, tremors
Stress/abstinence	Number of stress signs observed
Habituation	Assessment of state, observation of reaction to stimuli

Developmental Model

Our developmental model of the neonate has certainly come a long way since Sherrington's (1906) initial "spinal frog" model and the early reflex models. However, while the NNNS embraces many of the constructs of the competent infant, we are equally impressed with the immaturity, poorly differentiated, and limited nature of the newborn. The newborn can only do so much, and much of what it can do is affected

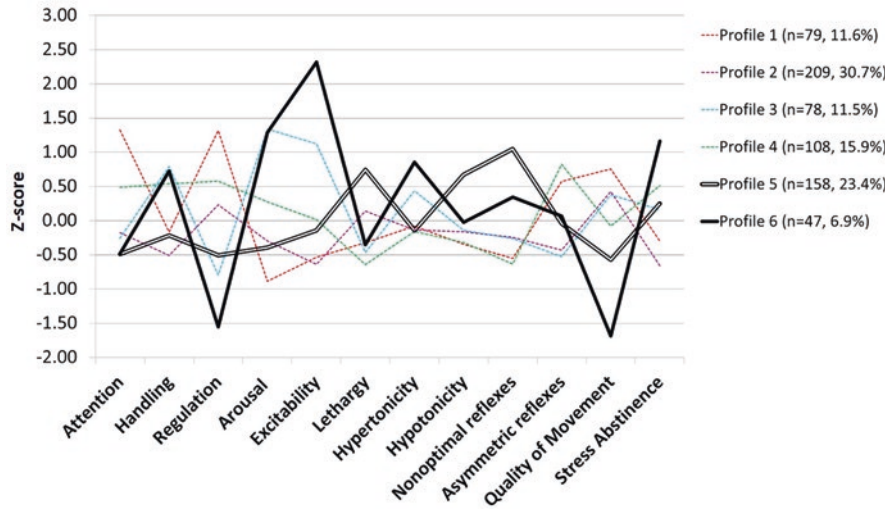

Fig. 10.1 Latent profile analysis of NNNS summary scores in preterm infants

by the very conditions under study (e.g., level of prematurity, effects of pre- and perinatal conditions, etc.). The NNNS portrays a comprehensive and integrated picture of the infant without weighting any specific functional domains. This holistic view assumes that an accurate assessment of the infant includes evaluation of classical reflexes, tone, posture, social and self-regulatory competencies, and signs of stress.

The high-risk infant is viewed as struggling to maintain a balance between competing demands. The preterm infant is trying to maintain physiological homeostasis in the face external stimulation. Internal demands such as maintaining respiratory and metabolic control are competing with external demands, such as the vast variety of external stimulation which increases respiratory and metabolic demands. The drug-exposed infant may be experiencing withdrawal or disturbances in monoaminergic systems that can result in hyper- or hypo-responsivity. The assessment of these infants is complex – a simple assessment of reflexes or tone will miss higher order functioning, regulatory capacities and coping strategies. Likewise, a focus on social interactive capacities will miss basic neurologic function that may determine current and future behavior. In sum, the NNNS is truly built on the work of those who preceded it. It evaluates the neurologic and behavioral competencies of the newborn and young infant and how well the infant is able to organize itself and its engagement with the environment.

Review of Prior Research Using the NNNS

Research using the NNNS has been robust. Since 1996, there have been 155 studies on the NNNS examining newborns with prenatal exposure to drugs, stress, psychopathology, chemical or toxicants, and preterm birth. Sixty-four studies included biomarkers such as heart rate variability and epigenetics, 12 studies included a measure of parenting, 34 predicted outcomes at later ages, and 22 studies used latent profiles.

Newborn Neurobehavioral Outcomes Following Prenatal Drug and Other Substance Exposures

In evaluating the effect of drugs, we know that polysubstance use is the norm, and only some studies accounted for the effects of polysubstance use. Also, the control or contrast sample as well as the exposed sample were at high risk for other factors known to affect performance, factors that were not always evaluated.

Prenatal Cocaine Exposure Infants with prenatal cocaine and other substance exposure had poorer auditory and visual attention, and showed more hypertonia and motor activity, jerkiness, startles, tremors, back arching, and signs of central nervous system and visual stress compared to unexposed, but not other substance exposed infants (Napiorkowski et al., 1996). Follow-up studies replicated these effects and also found that infants with prenatal cocaine exposure had more problems with self-regulation and lower initial motor scores. Their scores "caught up" to children with prenatal exposure to substances other than cocaine by age 18 (Conradt et al., 2013a, b; Lester et al., 2002). Some findings suggested that the group of infants who had the lowest neurobehavioral scores were exposed to heavier amounts of cocaine as well as cocaine and opioids (Lester et al., 2002). Diagnosed maternal depression was associated with poorer self-regulation, more excitability, and more hypertonia than exposed infants whose mothers were not diagnosed with depression.

Subsequent studies examined the associations of newborn neurobehavior and later behavioral challenges. Higher caregiving stress and more respiratory sinus arrhythmia withdrawal during the NNNS exam predicted more behavior dysregulation at 3 years (Conradt et al., 2016). Caregiver stress also interacted with neurobehavioral reactivity to predict infant temperament outcomes. Higher parenting stress was related to greater temperamental distress, but only for newborns with high neurobehavioral irritability scores (Sheinkopf et al., 2006). At 7 years of age prenatal cocaine and other substance exposure and newborn neurobehavioral dysregulation on the NNNS was associated with more temperamental distress and behavior problems (Lester & Tronick, 2009).

The NNNS exam has been used in several studies of drug-exposed infants to predict longer-term behavioral and cognitive outcomes. In the original paper to use profiles, two profiles, one hyper-dysregulated and the other hypo-dysregulated, predicted poorer behavior and cognitive outcomes at 1–5 years. These infants were more likely to have greater internalizing and externalizing behavior at age 3, and lower language scores at age 4 (Liu et al., 2010). The hyper-dysregulated were infants with an increased need for handling, poor self-regulation, high arousal and excitability, high hypertonicity, poor quality of movement, and greater stress abstinence signs at birth. In the hypo-dysregulated profile, the infants were more lethargic, hypotonic, and had poor quality of movement.

Prenatal Methamphetamine Exposure In the first study to document the neurodevelopmental effects of prenatal exposure to methamphetamine with the NNNS, Smith and colleagues (Smith et al., 2008) found that heavy methamphetamine use was related to lower arousal, more lethargy, and more physiological signs of stress. These findings were somewhat surprising since methamphetamine is frequently compared to cocaine in that both are sympathomimetic agents (LaGasse et al. 2011). However, neurobehavioral outcomes of methamphetamine predicted only the hypo-dysregulated newborn while neurobehavioral outcomes of cocaine appear to predict both the hyper-dysregulated and hypo-dysregulated infant. However, by one month, there were no differences in neurodevelopmental outcomes for infants with prenatal methamphetamine exposure relative to infants with prenatal exposure to substances other than methamphetamine (Kiblawi et al., 2014). Additionally, newborns exposed to both maternal depressive symptoms and methamphetamine had more autonomic stress signs and poorer quality of movement, and infants of mothers with depression had lower handling and arousal scores, increased stress abstinence, and more hypertonicity compared to infants whose caregivers had fewer symptoms of depression (some of whom were not exposed to methamphetamine but were exposed to tobacco, alcohol, and marijuana).

Prenatal Opioid Exposure The first study to assess the neurobehavioral performance of infants with prenatal opioid exposure was a randomized clinical trial evaluating the

neurodevelopmental effects of exposure to diluted tincture of opium and phenobarbital compared to diluted tincture of opium alone for treatment of neonatal abstinence syndrome (NAS), now typically referred to as Neonatal Opioid Withdrawal Syndrome (NOWS; Coyle et al., 2005). Since then, additional studies have used the NNNS to evaluate neurodevelopmental outcomes following treatment of NAS with methadone, buprenorphine, morphine, and clonidine (Bada et al., 2015; Coyle et al., 2012; Czynski et al., 2020; Jones et al., 2010; Velez et al., 2009). Compared to unexposed, healthy neonates, prenatal exposure to methadone was related to poorer attention, regulation, and quality of movement, and more excitability, arousal, non-optimal reflexes, hypertonicity, and stress abstinence (Wouldes & Woodward 2020). Infants exposed to buprenorphine had fewer stress abstinence signs, were less excitable, less aroused and hypertonic, required less handling to maintain a quiet alert state, and had better self-regulation (Coyle et al., 2012). In an RCT on the effects of clonidine vs morphine for the treatment of NOWS newborns given clonidine had lower arousal and excitability compared to newborns treated with morphine (Bada et al., 2015).

The NNNS has also been used to evaluate the neurodevelopmental consequences of prenatal opioid exposure and NOWS. Infants with prenatal exposure to methadone showed more arousal, excitability, and hypertonicity, as well as stress abstinence signs on the NNNS, but neurobehavior was not related to maternal methadone dose during pregnancy (Velez et al., 2009). In another study, newborn neurobehavior was related to maternal buprenorphine dose, with newborns with greater opioid exposure showing poorer quality of movement and self-regulation, and more stress abstinence signs with an increasing dose of buprenorphine (Velez et al., 2018).

Several studies have evaluated whether newborn neurobehavioral functioning can predict NOWS onset or severity. When the NNNS was compared to the Finnegan Neonatal Abstinence Scoring System, the NNNS explained more of the variance in NOWS symptoms than the NNNS and Finnegan combined, and the NNNS appeared more sensitive to identifying central nervous system signs of NOWS than the Finnegan (Chin Foo et al., 2021)

In a study examining how newborn neurobehavior differs depending on NOWS severity, infants with more severe NOWS were more likely to show an atypical NNNS profile characterized by greater need for handling, poor regulation, poor quality of movement, and more stress abstinence signs (Flannery et al., 2020). In another study, newborns with prenatal opioid exposure and NOWS showed changes in quality of movement, excitability, and lethargy and lower regulation compared to newborns with prenatal opioid exposure who did not require treatment for NOWS. The findings suggest that the NNNS gives a fuller picture of infants with NOWS and that it could be used as a marker or predictor of NOWS treatment response (Jones et al., 2010).

Prenatal Nicotine Exposure In the first study to evaluate the neurodevelopmental effects of prenatal exposure to nicotine, Law et al. (2003) found that newborns exposed to nicotine were more excitable, hypertonic, required more handling, and had more stress/abstinence signs compared to unexposed full-term infants. There was a dose-response relationship such that higher maternal salivary cotinine and more self-reported cigarette smoking per day predicted more stress/abstinence signs. Differences in neurobehavior have also been observed after prenatal exposure to lower levels of nicotine, with higher observed scores on arousal, excitability, and decreased self-regulation in White infants only, and in an independent study of infants of adolescent mothers who smoked cigarettes while pregnant (Barros et al., 2011; Yolton et al., 2009). Poorer attention, quality of movement, and self-regulation emerged in another study of prenatal exposure to nicotine and their unexposed counterparts (Stroud et al., 2018). However, by 10–27 days, neurobehavioral effects were only detected for an increased need for handling among infants exposed to nicotine compared to unexposed infants (Stroud et al., 2009).

Prenatal Marijuana Exposure Despite increases in marijuana use by pregnant women following the legalization of marijuana in many states (*State Medical Cannabis Laws*, 2023), only three studies have evaluated the impact of prenatal exposure to marijuana on newborn neurobehavior. Newborns with prenatal marijuana exposure born to adolescent mothers had higher arousal, lower regulation, and more excitability than unexposed newborns born to adolescent mothers (Barros et al., 2006). In two studies of newborns with both prenatal tobacco and marijuana exposure, marijuana exposed infants had lower regulation, attention, and more lethargy and need for handling to soothe, and infants exposed to both substances required almost twice as much need for self-soothing compared to tobacco exposure alone (Stroud et al., 2018). Male infants with prenatal tobacco and marijuana exposure also showed lower baseline cortisol over the first month of life (Stroud et al., 2020). Results across two independent samples therefore show some evidence for lower self-regulation in infants with prenatal marijuana exposure, which may be more pronounced when infants are exposed to both marijuana and tobacco.

In sum, for some infants, prenatal exposure to a variety of drugs could compromise infant neurobehavior in different ways, suggesting that different substances have specific effects. While more studies are needed to pin down these relations, what is clear is that exposed infants are at risk for poor state organization which may make caring for and interacting with these infants more challenging. Many women using substances during pregnancy struggle with mood disorders and experience high levels of prenatal stress. which compounds this effect and which could compromise their parenting capacities.

Newborn Neurobehavioral Outcomes Following Prenatal Exposure to Maternal Stress and Psychopathology

Maternal Mood Disorder Compared to women without psychiatric disorders, mothers with depression while pregnant had newborns with higher arousal, excitability, higher lethargy, hypotonicity, and stress abstinence signs (de Barros et al., 2013). Women who showed increasing levels of depression across pregnancy had infants who were more hypotonic than women with low or intermediate levels of depression across pregnancy (Marcus et al., 2011).

In these studies, however, authors did not account for the possibility that newborn neurobehavioral effects may have been due to maternal psychotropic medication use to treat their depression, or they excluded women using psychotropic medications for depression management. To attempt to disentangle the effects of psychotropic medication use and depression on neurobehavior, Salisbury and colleagues evaluated how prenatal exposure to depression, selective serotonin reuptake inhibitors (SSRIs), and benzodiazepines affected neurobehavior across the first month of life. They found that prenatal exposure to SSRIs, and SSRIs and benzodiazepine had significantly lower central nervous system signs of stress and lower motor scores across the first month of life, as well as lower self-regulation and higher arousal on day 14. Newborns exposed to depression only had low arousal throughout the first month of life and showed arousal levels similar to newborns unexposed to depression, SSRIs, or benzodiazepine (Salisbury et al., 2011).

Emotion Dysregulation and Prenatal Maternal Adversity Women who struggle with recognizing and managing their emotions show higher emotion dysregulation, a transdiagnostic vulnerability for a wide range of psychiatric conditions, including depression. Several studies have evaluated the effects of prenatal exposure to maternal emotion dysregulation on newborn neurobehavior. High prenatal exposure to emotion dysregulation and greater economic hardship predicted a blunted/hypo-aroused neurobehavioral phenotype comprised of low attention and arousal (Gao et al., 2021). This phenotype was not predicted by prenatal maternal cortisol levels, even though mothers with high emotion dysregula-

tion had higher chronic cortisol output (Conradt et al., 2020). However, in follow-up work, this group showed that mothers who reported more mindfulness had infants with higher attention, even if they also reported more emotion dysregulation. In other words, greater maternal mindfulness strategies buffered the infant from prenatal exposure to emotion dysregulation (Ostlund et al., 2021).

The extent to which newborn neurobehavior could predict emotion regulation capacities in infants was evaluated in two studies. Bolten et al. (2013) found that high newborn neurobehavioral reactivity predicted lower emotion regulation skills at 6 months, but only for infants whose mothers had higher chronic cortisol output during pregnancy. Gao and colleagues (2021) showed that higher newborn arousal at birth predicted slower parasympathetic nervous system recovery from stress at 6 months, a possible physiological index of poorer self-regulation. These studies demonstrate that newborn neurobehavior may be used to identify early neurodevelopmental phenotypes predictive of emotion regulation in infancy.

Associations between general measures of prenatal adversity and newborn neurobehavior were evaluated in two studies, and findings were mixed. In a home visiting intervention, no significant associations were found between prenatal maternal adversity and newborn neurobehavior (Bowers et al., 2021). However, in a sample of preterm infants, high prenatal maternal anxiety, depression, and environmental risk predicted lower attention, more lethargy, lower self-regulation, and poorer quality of movement (Hofheimer et al., 2020).

Taken together, these studies show that aspects of newborn neurobehavior can be identified at birth that are sensitive to a range of prenatal maternal psychosocial risk factors ranging from depression to emotion dysregulation.

Newborn Neurobehavioral Outcomes Following Prenatal Exposure to Chemicals and Environmental Toxicants Such as Pesticides and Pollution (13 Studies)

For years scientists have been interested in determining the extent to which pollutants can impact physiological aspects of health and well-being. A growing body of research is now beginning to evaluate the extent to which prenatal exposure to environmental toxicants could also have consequences for newborn neurobehavioral functioning.

A range of toxicants are found in everyday household items in the United States, sometimes with known carcinogenic and/or endocrine-disrupting properties (e.g., Bisphenol A; BPA, and phthalates). Greater exposure to phthalates in the second trimester of pregnancy, but not BPA, predicted decreased arousal and handling, and increased self-regulation (Yolton et al., 2011). The effects of phthalate exposure on newborn neurobehavior was partially replicated in a separate cohort of preterm newborns. Exposure to phthalates predicted higher attention (Karthik et al., 2014). In a follow-up study greater prenatal exposure to diethylphosphate metabolites, a type of pesticide, and newborn neurobehavior, chemicals predicted higher attention, lower lethargy, and lower hypotonia, as well as fewer autonomic signs of stress. Women who identified as white, were married, and had more education, and who reported more consumption of fruits and vegetables also had higher concentrations of these chemicals during pregnancy, suggesting that socioeconomic advantage and improved nutrition may be a stronger predictor of newborn neurobehavior than prenatal diethylphosphate exposure (Yolton et al., 2013). The effects of flame retardants and cleaning materials on newborn neurobehavior found prenatal exposure to prenatal perfluorooctanoic acid, found in cleaning prod-

ucts, increased the likelihood that newborns would exhibit hypotonia.

Other chemicals, including mercury, are known to cross the placenta and could impact brain development *in utero* and subsequent neurobehavior. Prenatal exposure to mercury was related to hypomethylation of the *EMID2* gene, implicated in brain development, which in turn predicted a hyper-dysregulated profile of newborn neurobehavior characterized by poor quality of movement, low self-regulation, greater need for handling to remain calm, more stress signs and excitability. In contrast, in a cohort of children whose mothers reported lower fish consumption and consequently whose children had lower levels of mercury exposure, higher prenatal mercury exposure predicted more asymmetric reflexes in girls. Mothers who reported consuming more fish and whose children had higher mercury exposure had infants with higher attention and who needed less handling, which may be a consequence of the nutritional benefits of fish consumption (Xu et al., 2016).

Other chemical exposures show U-shaped associations with neurodevelopment such that excessively low or high levels can have problematic neurodevelopmental consequences. Selenium, found in soil, is a micronutrient, and essential for healthy development, but toxic at excessive levels. Prenatal exposure to placental selenium was related to poorer muscle tone at birth, possibly via DNA methylation of *GFI1,* which could be related to placental cell apoptosis (i.e., cell death; Tian et al., 2020).

The effects of air pollution and toxic metals on human health are profound at high levels. In the first study of its kind, prenatal exposure to air pollution from traffic along major roadways predicted poorer motor development in preterm infants (Zhang et al., 2020). Prenatal exposure to a wide range of toxic metals predicted hyper-dysregulated neurobehavior comprised of high arousal, excitability, hypertonicity, and stress abstinence, and low quality of movement, regulation, and non-optimal (Tung et al., 2022). In follow-up work it appeared as though prenatal exposure to cadmium and lead, which can be detected in the placenta following exposure via maternal diet, smoking, or industrial contamination, had the strongest association with hyper-dysregulation (Tung et al., 2022). Another follow-up study showed that the effect of prenatal cadmium exposure on quality of movement and excitability may be explained in part by microRNA expression in the placenta (Tehrani et al., 2022).

In sum a large number of studies show how sensitive neurobehavior is to a wide variety of prenatal exposures and insults, from prenatal maternal substance use, to psychopathology, to environmental toxicants and pollution. Researchers have not only begun to document how prenatal exposures have neurodevelopmental consequences but also whether neurodevelopmental and biological markers of risk can be used for early identification of neurodevelopmental challenges. Understanding the biological mechanisms by which early life exposures could affect neurodevelopment have also been evaluated.

Newborn Neurobehavior: Epigenetic, Neurobiological, and Physiological Markers

Newborn neurobehavior is thought to index fetal central nervous system development and as such has been evaluated along with a number of biological indices of fetal development and exposures. A large and growing body of literature shows epigenetic correlates and/or mediators of neurodevelopmental outcomes, examined largely from the placenta. In preterm infants in particular there is an interest in neurological correlates of preterm birth and neurodevelopment. Finally, a large number of studies evaluate how newborn neurobehavior is associated with physiological performance in the newborn.

Epigenetic Markers The mechanisms by which early life exposures could impact neurodevelopment have included a growing number of studies evaluating epigenetic markers in the placenta. The overarching premise of this work is that a range of prenatal exposures could affect fetal development via changes in epigenetic mechanisms, such as DNA methylation, in the placenta or evaluated in cord blood or buccal cells in infants. The first series of studies typically interrogated potential candidate epi-

genetic mechanisms. For example, the glucocorticoid receptor gene, *NR3c1*, regulates HPA axis functioning and in animal studies is sensitive to both prenatal stress and offspring behavior. Higher DNA methylation of the glucocorticoid receptor gene was related to more dysregulated neurobehavior on the NNNS. Stroud and colleagues found that DNA methylation of the glucocorticoid receptor gene mediated the effect of maternal smoking during pregnancy on lethargic behavior (Stroud et al., 2016). DNA methylation of *NR3c1* was also a marker of poor lethargy, hypotonia, and self-regulation, as well as quality of movement and attention in a sample of typically developing children (Conradt et al., 2013a, b). Additional candidate epigenetic work with genes implicated in neuroendocrine functioning revealed that greater DNA methylation of *FKBP5*, which modulates glucocorticoid receptor activity, predicted greater newborn arousal (Paquette et al., 2015). *11βHSD2*, which regulates prenatal exposure to maternal cortisol, predicted lower quality of movement and was a marker of hypotonia for infants of mothers who reported more anxiety (Conradt et al., 2013a, b).

While DNA methylation is arguably the most widely studied epigenetic mechanism in human behavioral research, additional epigenetic mechanisms, such as genetic imprinting, have been evaluated with respect to neurodevelopmental outcomes. Genetic imprinting is an epigenetic mechanism related to the silencing of certain genes in a parent-of-origin fashion. For example, the expression of ten imprinted genes was related to reduced quality of movement, increased asymmetrical and non-optimal reflexes, and more stress abstinence signs (Green et al., 2015; Marsit et al. 2012). In follow-up work, prenatal maternal depression and anxiety were related to imprinted gene expression, but imprinted gene expression was not related to newborn neurobehavior (Litzky et al., 2018).

Epigenome-wide association studies interrogate almost the entire epigenome and allow for discovery of potentially novel epigenetic signatures of newborn neurobehavior. In one study, two genes implicated in neurodevelopmental disorders, *FHIT* and *ANKRD11*, were associated with newborn attention (Paquette et al., 2016). In a follow-up study with preterm infants, infants showing more hyper-dysregulation on the NNNS showed differential methylation in genes related to neurological development and neurodevelopmental disorders (Everson et al., 2019).

Physiological Markers Given the associations identified between epigenetic markers of neuroendocrine functioning and newborn neurobehavior, several researchers have sought to test whether neurobehavior could be related to psychophysiological-based measures of neuroendocrine functioning in particular and stress more broadly. For example, higher cortisol levels in preterm infants predicted lower regulation and attention scores and more lethargy on the NNNS, though no direct effects of prenatal maternal cortisol output and newborn neurobehavior was observed in a separate study of healthy term infants (Conradt et al., 2020; Zhang et al., 2022). Neuroendocrine functioning may also mediate associations between prenatal exposures and newborn neurobehavior. Infants of mothers with high and increasing levels of depression across the pregnancy had higher ACTH levels and were more hypotonic and habituated more quickly to sound (Marcus et al., 2011).

In addition to neuroendocrine markers of stress, associations between autonomic nervous system functioning, gut microbiome, and neurobehavioral outcomes has supported the validity of the NNNS exam for measuring early signs of stress in the newborn. For example, in studies of infants with prenatal exposure to cocaine and opioids was related to high baseline heart rate and low baseline respiratory sinus arrhythmia, a physiological indicator of self-regulation. These infants also had the lowest quality of movement and highest hypertonicity scores compared to newborns exposed to substances other than cocaine and opioids (Conradt et al., 2013a, b). Higher baseline heart rate was also related to higher arousal, lower self-regulation, poorer quality of movement, higher excitability, and lower lethargy across all infants with prenatal substance exposure in this study (Conradt et al.,

2013a, b). In two manuscripts examining microbiome-neurobehavioral associations, stress abstinence scores were lower in infants with gut microbiomes from breastfed infants (Sun et al., 2020). Specific gut microbiome concentrations were also related to stress abstinence, handling, and quality of movement scores on the NNNS (Chen et al., 2023). These studies show that physiological indicators of early life stress – measured with neuroendocrine markers, the gut microbiome, and measures of the autonomic nervous system – may be useful as biomarkers for newborn neurobehavior in preterm infants and in infants with prenatal substance exposure.

Neurological Markers Neurological markers could be used in conjunction with behaviorally-based neurodevelopmental data in groups of children at risk for neurodevelopmental delay, including children born preterm, to aid in early identification of neurodevelopmental challenges. Data from independent laboratories show poorer NNNS scores with earlier birth, and that these scores are related to brain abnormalities (e.g., cortical gray matter abnormalities and white matter microstructure and injury, as well as larger ventricle sizes and delayed gyral maturation) on MRI. Preterm infants with white matter damage had lower attention, hypotonicity, and poorer quality of movement (Helderman et al., 2022). Using diffusion tensor imaging in infants with hypoxic-ischemic encephalopathy, indicators of microstructural brain injury in the corticospinal tract were related to poorer motor performance on the NNNS, and more severe brain injury on MRI, as well as motor challenges at age 2 (Massaro et al., 2015).

Infants in the NICU are exposed a wide range of stressors including increased noise, sleep disruptions due to caregiving needs, needle sticks, and bright lights. Exposure to more NICU-related stress as evaluated by nurses was related to poorer motor behavior on the NNNS. More NICU stress was related to altered temporal lobe functional connectivity, as well as decreased frontal and parietal brain width (Smith et al., 2011).

In sum, across a range of independent samples and research groups, neurodevelopment – particularly neuromotor development – appears quite sensitive to neurological measures of brain injury in infants born preterm.

Newborn Neurobehavior and Preterm Birth

Many of the preterm birth studies were reviewed in other sections related to prenatal substance exposure, prenatal exposure to maternal psychopathology, prenatal exposure to chemicals such as phthalates, and when examining biomarkers of newborn neurobehavior. A major advantage of using the NNNS exam in longitudinal developmental research is to evaluate, at birth, whether a newborn may show early signs of risk for neurodevelopmental delay. The utility of this exam is particularly apparent in studies of preterm birth, where the majority of parents and clinicians seek to identify early signs that the neonate is improving neurodevelopmentally or may be on a riskier neurodevelopmental trajectory. For example, at term equivalent, infants born less than 30 weeks had lower attention, self-regulation, poorer reflexes, and more excitability, stress signs, required more handling, and showed more hypertonicity, and hypotonia compared to their full-term counterparts. These infants also showed poorer quality of movement, more hypertonia, more arousal and excitability, but also less hypotonia and less lethargy from 34 weeks postmenstrual age to term equivalent.

Neurobehavior may be sensitive to brief interventions conducted in the NICU setting. In an intervention, preterm infants who heard their mother's voice between 30 and 32 weeks, had improved attention and quality of movement compared to controls (Picciolini et al., 2014). In addition, preterm infants receiving Kangaroo Care had higher attention, arousal, regulation, nonoptimal reflexes and quality of movement, and lower need for handling, excitability, and lethargy compared to a control group of infants who did not receive Kangaroo Care (El-Farrash et al., 2020). These findings show that the NNNS

can be a useful measure for evaluating changes in neurodevelopmental performance during the infant's hospitalization in the NICU), as well as changes to intervention in the NICU.

As mentioned previously, latent profile analysis has proven to be a particularly useful tool for identifying subgroups of neonates with varying neurodevelopmental profiles. Longitudinal follow-up studies with these newborns can then be conducted to determine whether there are particular profiles of neonates who later show neurodevelopmental challenges, such as low mental or motor development scores, or more problem behavior. Latent Profile Analysis with a large (N = 556) number of infants born very preterm (<30 weeks GA) to predict whether certain subgroups would show concerning neurodevelopmental outcomes in early childhood (McGowan et al., 2022). Two subgroups were identified (hypo- and hyper-dysregulated, (Fig. 10.1) that, along with medical and psychosocial risk, predicted risk for poor motor and behavioral development. The two dysregulated groups were combined to form a single "behavioral risk" group. Medical risk – experiencing two or more major medical diagnoses in the NICU – was also considered. At age 2 years, Bayley-III motor, language, and mental development scores were considered, along with internalizing, externalizing, and total problem behaviors on the CBCL.

Results from this study indicated that developmental and behavioral risks could be identified in early childhood when considering neurodevelopment before NICU discharge, as well as medical risks in preterm infants (Table 10.2). Infants with both behavioral risk profiles at birth and medical risk factors were more likely to show motor delays at age 2 compared to infants without these risk factors (Liu et al., 2010). Infants with high behavioral risk only were more likely to show elevated internalizing behavior at 2 years compared to infants with low behavioral and medical risk. This study was the first of its kind to use neurodevelopmental and medical data at birth to identify early signs of developmental risk at age 2 years in preterm infants. These findings suggest that neonatal neurobehavior makes a unique and substantial contribution to the prediction of developmental challenges in preterm infants that warrants the development of intervention programs to improve social and emotional outcomes.

Using latent profile analysis to identify subgroups of infants with varying neurodevelopmental profiles has been used in 22 studies in a wide range of groups including infants with prenatal substance exposure and healthy term infants. Next, we describe how latent profile analysis is used in other populations to identify early indicators of risk for long-term neurodevelopmental challenges.

Using Latent Profile Analysis of the NNNS Exam for Prediction of Long-Term Neurodevelopmental Outcomes

Findings from a large number of children support the utility of the NNNS exam for early identification of neurodevelopmental risk as a consequence of preterm infants experiencing a range of prenatal exposures from prenatal substance exposure to preterm birth. In 2010 the first paper was published examining profiles of newborn neurobehavior that showed strong predictive validity. Substance exposed newborns who had low attention, self-regulation, and quality of movement, required more handling to be soothed, had high arousal, excitability, and hypertonicity, and had the most stress abstinence signs had the lowest IQ and adaptive behavior scores and most externalizing and internalizing problems 4.5 years later (Liu et al., 2010).

A "typical" healthy profile of newborns who are well-regulated, have high attention, and require minimal handling, average tone and reflexes, and few stress abstinence signs has been found in newborns with and without prenatal substance exposure in these studies (Czynski et al., 2020; Flannery et al., 2020; McGowan et al., 2022; Sucharew et al., 2012; Wouldes & Woodward 2020). These infants show typical levels of internalizing and externalizing behavior, as well as average mental and psychomotor development (McGowan et al., 2022; Sucharew et al., 2012). In contrast, the "dys-

Table 10.2 NNNS profiles predict two-year developmental outcomes in preterm infants

		Low behavioral risk with high medical risk		High behavioral risk with low medical risk		High behavioral risk with high medical risk	
Outcome	No.	RR (95% CI)	aRR (95% CI)[a]	RR (95% CI)	aRR (95% CI)[a]	RR (95% CI)	aRR (95% CI)[a]
Bayley-III							
No.	220	76	76	106	106	38	38
Cognitive composite <85	131	1.4 (0.9–2.2)	1.2 (0.7–1.8)	1.1 (0.7–1.8)	1.2 (0.8–1.8)	2.6 (1.8–3.8)	**2.7 (1.8–3.4)**
Language composite <85	204	1.4 (1.1–1.9)	1.3 (0.9–3.9)	1.1 (0.8–1.5)	1.0 (0.7–1.4)	1.6 (1.2–2.3)	1.3 (0.8–1.9)
Motor composite <85	102	3.4 (2.2–5.4)	2.8 (1.8–3.9)	1.8 (1.1–3.1)	1.8 (1.1–2.7)	5.1 (3.2–8.0)	**4.1 (2.9–5.1)**
child behavior checklist							
No.	236	79	79	113	113	44	44
Internalizing T score >63	43	1.0 (0.4–2.7)	0.9 (0.3–2.4)	1.9 (0.9–3.7)	**2.3 (1.1–4.5)**	2.2 (0.9–5.2)	2.2 (0.6–6.4)
Externalizing T score >63	54	1.0 (0.4–2.2)	0.8 (0.3–1.8)	1.4 (0.7–2.5)	1.4 (0.7–2.7)	1.0 (0.4–2.7)	0.8 (0.2–2.7)
Total problem score >63	53	1.4 (0.6–2.9)	1.3 (0.5–2.9)	1.9 (1.1–3.4)	**2.5 (1.2–4.4)**	1.8 (0.8–4.2)	2.3 (0.7–5.4)

Abbreviations: *aRR* adjusted relative risk, *Bayley-III* Bayley Scales of Infant and Toddler Development, third edition, *RR* relative risk

[a]Adjusted for low socioeconomic status, minority race or ethnicity, maternal primary language, no partner, Brief Symptom Inventory average, postmenstrual age at birth, infant sex, and study site

regulated" group of infants includes two different profiles in some samples of preterm infants, infants with prenatal substance exposure, and even in typically developing infants. One group is hyper-dysregulated, with a high need for handling to stay calm, low regulation, low quality of movement, high arousal and excitability, and high-stress abstinence has been identified as well as replicated. These infants tend to show the highest internalizing, externalizing, and total behavior problems in early childhood (2–3 years; Czynski et al., 2020; McGowan et al., 2022; Wouldes & Woodward 2020) as well as the poorest developmental scores. The second profile is a hypo-aroused group of newborns with high hypotonia, high lethargy, and high non-optimal reflexes. Between 2–3 years of age, Sucharew and colleagues found that the hypo-regulated infants had significantly lower psychomotor development compared to the hyper-dysregulated and typically developing infants, and significantly lower externalizing behavior compared to the typically developing infants (Sucharew et al., 2012).

Summary of the State of Research with the NNNS Across 155 studies from a variety of laboratories and in independent samples, findings indicate that the NNNS is both sensitive to a wide range of prenatal exposures and may identify two specific subgroups of infants – a hyper-dysregulated profile and a hypo-dysregulated profile – that are at risk for higher internalizing and externalizing behavior, as well as developmental delay in early childhood. These findings demonstrate that the predictive validity of the NNNS is robust. These findings are particularly promising when considering how the NNNS could be used as an early intervention tool. For example, as an assessment, it could aid in early identification of neurodevelopmental risk. It can also be integrated as an intervention to identify specific areas of support for the neonate at risk for later neurodevelopmental delay.

From research to Clinical Practice

Although the NNNS was originally developed for research, it is increasingly being used in clinical practice. The clinical use of the NNNS is warranted from the reviewed literature, which has found that neurobehavioral dysregulation can be reliably measured in the neonate before hospital discharge and that it predicts long-term developmental outcomes. For example, newborns with prenatal substance exposure, including infants born preterm, who showed poor regulation, were difficult to soothe, exhibited high levels of arousal, and low attention, were at risk for internalizing and externalizing problems at 18 months, as well as academic difficulties and low IQ in early childhood (Flannery et al., 2020; Liu et al., 2010). Preterm infants with poor reflexes, measured with the NNNS, had poorer language and cognitive outcomes in infancy (Czynski et al., 2020). Preterm newborns with high levels of excitability, low self-regulation, and poor reflexes were also more like to show cognitive and motor delays between 18 months and 2 years.

Our approach is to view the high-risk infant as struggling to maintain a neurobiological balance between internal physiological demands and competing demands from the external environment (Lester et al., 2004). For example, maintaining physiological homeostasis in the face of external stimulation that increases respiratory and metabolic demands competes with internal demands to maintain a relatively stable balance among physiological processes. The neurobehavioral expression of this balance is what we refer to as regulation seen in the infant's ability to modulate state (sleep through alertness and crying states), soothability, control over posture and tone, ability to engage with the inanimate environment, and in social interaction in the face of varying levels of stress. When regulation of these competing demands is insufficient, one can think of the energetic demands of these factors as depleting resources or deflecting resources away from current ongoing growth and development.

The goal of our clinical work with the NNNS is to help the infant improve regulatory abilities, which involves supporting the infant to cope with these competing internal and external demands while at the same time expanding the infant's behavioral repertoire. Fulfilling this

goal involves striking an ongoing dynamic balance between over- or under-protection. That is from the infant experiencing too little external and internal stimulation or exposure to too much stimulation and from the infant experiencing too little stress to experiencing toxic stress. Ours is a dynamic "repair-and-expand" growth model in which we address regulatory challenges, as well as regulatory strengths through techniques such as scaffolding (Tronick, 2017). Scaffolding is a handling strategy that aims to provide just enough regulatory support to makes up for the infant's lack of capacity to generate the behavior on their own. With the appropriate amount of scaffolding, the infant not only generates the behavior but develops the capacity to do it on their own. Scaffolding promotes developmental growth by giving the infant more opportunities to engage with the environment, to initiate contact with the environment, and experience the environment in new ways while at the same time regulating internal physiologic demands. An example would be scaffolding infant to maintain longer periods of alertness by gentle rocking. It provides the infant with a bit more organizing stimulation and simultaneously increases the infant's ability to sustain engagement with the environment.

Guidelines for using the NNNS in clinical practice have been developed, and additional training and certification are provided for trained NNNS examiners who are also clinically trained. In general, the NNNS is administered and scored as part of standard care for designated populations and/or on a consulting basis. The exam itself is not altered for clinical use. Rather, the summary scores are interpreted for clinical use with each individual infant. Designated populations include, but are not limited to, preterm infants (usually below a specified gestational age at birth), infants with prenatal substance exposure (e.g. prenatal opioid exposure), infants with specific medical conditions (e.g., hypoxic-ischemic encephalopathy, clinical seizure activity, and cardiac surgery). Consultations, for example, are often related to hypo/hypertonic muscle tone, decreased attention and inconsolability, or readiness for the infant to go home. Following the administration of the NNNS, the results of the exam are summarized with specific individualized recommendations for management and care recorded in the infant's medical record. Importantly, the NNNS examiners are available for follow-up discussions with clinical staff. The results of the NNNS can also be included in the infant's hospital discharge summary relayed to the infant's primary care provider and early interventionist. Critically, the NNNS assesses infant neurobehavioral abilities that can be used as targets for intervention with parents and interventionists, which could mitigate long-term developmental deficits. A case study example of how the NNNS is used in clinical practice is shown in Fig. 10.2.

The exam is scored, eight summary scores (Table 10.1) are computed and converted to percentiles. Figure 10.2 is from a preterm infant. Summary scores are on the X-axis, and the corresponding percentiles on the Y axis. The specific percentiles for each summary score are shown in the circles. Scores at the upper or lower 20th percentile indicate dysregulation. For the infant in Fig. 10.2, neurobehavioral domains of dysregulation are shown by poor attention, regulation, and movement, and a high number of signs of stress. The domain of strength in this infant is that the infant was responsive and did not require more than an average amount of handling. Thus, treatment might include refining the infant's regulatory skills, thereby improving the infant's attention, regulation, movement, and stress scores. Over time, as the infant's regulatory abilities continue to improve, we would look for changes such as increased attention with less handling without compromising other summary score domains, thereby increasing opportunities for the infant to engage with the environment on their own. However, it is important to note that the summary scores are not treated in isolation but are interpreted within the context of the whole child. For example, if this infant's stress score was lower, we might advocate using scaffolding to increase handling. The longer-term plan would also depend on when, during the infant's hospital stay, the NNNS is

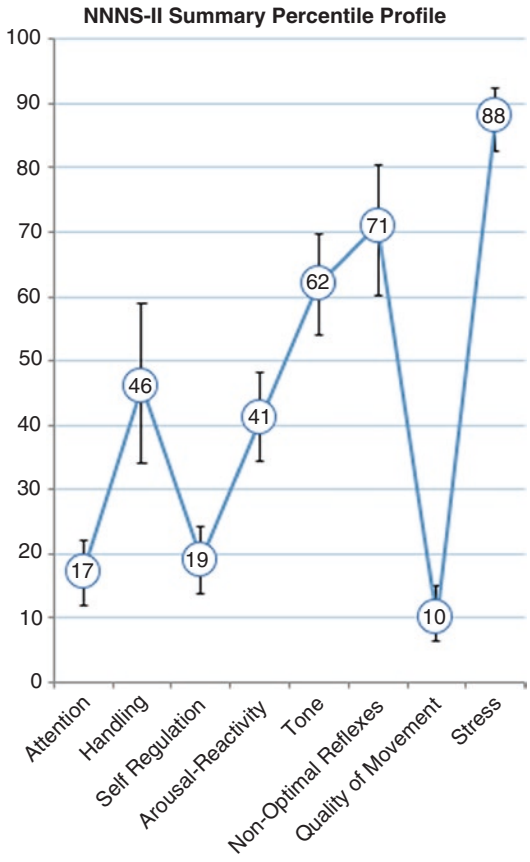

Fig. 10.2 Example summary score profile to be used for personalized regulatory skills intervention

administered. For example, with preterm infants, the NNNS is often administrated twice, once when the infant is medically stable (usually 33–34 weeks gestational age) and then a few days before discharge. The first exam is used to make recommendations for the acute management of the infant during hospital stay with the second exam more focused on the transition home and the postdischarge management of the infant, given the changes found between the second and first exams.

Although there may be feasibility constraints, we think it is best at some point to do the NNNS in the presence of the infant's caregiver(s), most often the mother. In a busy NICU and with the demands on parents, visitation, other children, etc., it is not always possible to do the exam with caregivers. In this case, the exam should be discussed with the caregiver. When doing an exam with caregivers, we are sharing our observations of the infant's strengths and vulnerabilities, which we know is going to have an impact and likely change how the caregivers view and handle the baby. We, of course, do this deliberately and help the caregiver improve their skills in handling the baby, which can, in turn, improve the infant's neurobehavior. Thus, caregivers become agents of change and acquire skills that will carry forward at home following NICU discharge. Changing the caregiver changes the infant. Moreover, this improves the developing infant caregiver relationship improves parental self-esteem and confidence in parenting. And we know, of course, that this developing relationship is reciprocal as changes in the infant will then be feedback on and change caregiver behavior.

After all, it is the caregiver(s) who will take the infant home and care for the infant on an ongoing – moment-by-moment, daily – basis. However, examining the infant and working with the caregiver is a demanding multidimensional skill that involves issues unrelated to being an effective examiner. Many NNNS examiners may not be trained or equipped to be present for both the newborn and the caregiver. For example, it may be challenging for an examiner to attend to both the infant and answer important caregiver questions "in-the-moment." Their questions, of course, are, "is that normal?" and "how will I be able to take care of this baby?" along with all the issues these questions imply. While, the parent may not articulate a question, nonetheless, the examiner needs to keep in mind the parents' concerns and worries and comment on the behavior in a way that mitigates their concerns and supports their capacities.

The issue for the examiner and the parent is especially demanding when the infant is dysregulated and hyperreactive. In the face of a dysregulated infant, the examiner has to be able to remain calm and to not share the anxiety he or she may be experienced with the parent. The examiner needs to keep in mind that the goals in doing the NNNS with the parent are to help them to see what in a descriptive sense their infant is like, to help the parent develop scaffolding behaviors

that fit to their infant, and most critically to use the information to facilitate the parent-infant relationship. Working in a sensitive clinically effective manner with these parental and relationship issues goes well beyond the "simple" administration of the NNNS.

Even in an examination of well-regulated infant parental issues will emerge. Parent health issues or fears for the infant or for the parent's own capacity to parent often emerge. Pregnancy and postpartum are periods of unusually high levels of anxiety, radical shifts of emotions, including depressive symptoms and euphoria, and *all* parents have ghosts, as well as, angels in their nursery. Caregivers may have personal issues that inhibit their ability to be "ready" to engage with their infant. There are also socio-demographic and cultural issues that need to be respected.

Dealing with these issues requires clinical skills. Training in infant-parent mental health or early relational health provides broader and more sophisticated training and better prepares the examiner for the variety and idiosyncratic manifestations of infant and parent service. It is for this reason that the clinical use of the NNNS requires a clinical background as well as additional training and certification. Moreover, and to be concrete and practical, training in early relational health will enable a single provider to carry out the work and, in many contexts, be able to bill for the service. Despite these issues and demands, using what we have learned from the NNNS enables the development of individualized interventions fitted to the infants' regulatory and behavioral characteristics. Moreover, the intervention can be quantitatively based using profiles and summary scores.

Summary and Key Points

The NNNS is a clinical tool that predicts developmental outcome and informs targeted interventions prior to NICU discharge. For example, we now have the ability to identify which individual infants are most likely to have developmental and behavioral problems at age two. We have the opportunity, if not the obligation, to develop NNNS-based targeted individualized interventions that target both the infant and caregiver to mitigate developmental deficits in preterm, and by extension, other at-risk infant populations. The fact that we have to plan such programs for only those "most" at risk is already an acknowledgment of limited resources. We also acknowledge that such programs need to face issues of practicality, scalability and implementation in the current healthcare environment and that extends to the postdischarge home environment.

In conclusion, the NNNS is a translational example of going from bench (perhaps crib) to bedside. Research using it has demonstrated its sensitivity to neurobehavioral issues and its effectiveness in predicting later developmental risk. The research has characterized profiles of infants, types of infants if you will, that have different neurobehavioral ways of regulating themselves and engaging with their caretakers and the world around them. This research has uncovered profiles that make clinical sense to experienced medical providers and to parents. Most important they are the basis for an interventionist developing individualized interventions for each infant and scaffolding parents' caretaking. As such the NNNS is a robust research and clinical instrument.

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11 Social Co-regulation of the Autonomic Nervous System Between Infants and Their Caregivers

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Acronyms

ACM	Adaptive calibration model
ANS	Autonomic nervous system
EDA	Electrodermal activity
HPA	Hypothalamic–pituitary–adrenal
PFC	Prefrontal cortex
PNS	Parasympathetic nervous system
PTSD	Post Traumatic Stress Disorder
PVT	Polyvagal theory
RSA	Respiratory sinus arrhythmia
SNS	Sympathetic nervous system
VVC	Ventral vagal complex

Newborns have sophisticated and multi-modal capacities for co-regulating with caregivers. These abilities are supported by the social coordination of physiological activity, such as heart rate, respiration, and muscle tone, which modulate arousal and the infants' behavioral repertoire. The complex dynamics of tracking moment-to-moment physiological needs, activating distress reactions, and calming for affiliative social interactions is coordinated between the brain and body by the autonomic nervous system, a network of neural connections that links the brainstem, spinal cord, and tissues and organs (Cannon, 1932; Hess, 1948; Jänig, 2022) and provides a physiological component of emotional arousal and regulation (Porges et al., 1994; Thayer & Lane, 2000; MacCormack et al., 2021). These functions are neuroanatomically linked with brainstem pathways that coordinate social signaling (Porges & Furman, 2011) and higher-level brain circuits that detect safety and threat cues (Thayer & Lane, 2000; Thayer et al., 2012). This coordinating role makes the autonomic nervous system a critical transdiagnostic component of mental and physical health, as evidenced by studies that show disrupted autonomic function in anxiety, depression, and post-traumatic stress disorder (PTSD; Kemp et al., 2010; Chalmers et al., 2014; Koenig et al., 2016) as well as aspects of somatic function such as regulation of the gut (Kolacz et al., 2019) (Fig. 11.1).

Though the autonomic functions that coordinate physiological dynamics during social interactions are emerging in infancy, they nonetheless

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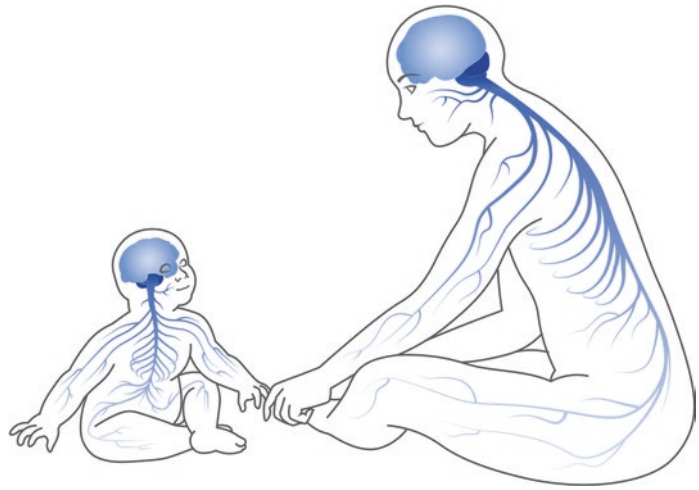

Fig. 11.1 The autonomic nervous systems of caregivers and infants are integrated with social signals such as voice and touch, helping to co-regulate their physiological states at a time when infants' capacities for self-regulation are in early stages of development

support rich capacities for co-regulation even in early life. Over time, caregiver-infant interaction patterns may shape the development of a child's capacity to self-regulate (Feldman et al., 1999; Tronick, 2007). In this chapter, we elaborate on threat and safety communication in infant-caregiver interactions, demonstrate the role of autonomic function in integrating brain-body social coordination in caregiver and child, and describe how early experiences of co-regulation set the stage for psychosocial development through the life course. With these goals in mind, we first provide an overview of the autonomic nervous system, its anatomical development in early life, and common measurement methods in infants and adults.

Anatomy and Early Development of the Autonomic Nervous System

The autonomic nervous system (ANS) is a network of pathways that connect the body to the central nervous system, with the brainstem and spinal cord serving as important hubs. The ANS regulates the activity of organs and tissues, integrates and transmits information about the state of the body and environment to the brain, and coordinates responses to perceived and anticipated challenges and threats. (Porges, 1995; Sterling, 2012; Jänig, 2022). In newborns, it can coordinate the body's moment-to-moment activities to meet metabolic needs. However, the ANS undergoes substantial development during the first years of life, allowing improved precision in state regulation. Prototypical states include calm social engagement and mobilization to perceived danger or life threat, which set a foundation for interpersonal interactions and mutual threat responses in caregivers and newborns. The autonomic nervous system has been classically divided into subsystems based on anatomical distinctions: the sympathetic and parasympathetic (Langley, 1921; for discussion of the development of the enteric nervous system, its connection to sympathetic and vagal components, and ambiguities about its categorization see Rao & Gershon, 2018).

The heart is a crucial organ involved in supporting the body's states of calm and arousal. While the heart has its own pacemaker cells and can beat independently of the brain, it receives signals from the autonomic nervous system that enable it to adjust its functioning based on current and anticipated needs. These signals contribute to dynamic and precise shifts in state regulation. Because of its importance for state regulation and its widespread use in research, we now turn to a brief review of parasympathetic and sympathetic innervation patterns. This section

will focus on the early life development of autonomic regulation of the heart, laying the groundwork for the later review of studies that use the heart as an index of state regulation.

Parasympathetic nervous system. Signals from the myelinated vagus actively slow the heart below the pace of the heart's primary pacemaker and can be rapidly withdrawn to speed up heart rate and mount a metabolic response to challenge. In adulthood, outflow from the vagus nerve is the strongest influence on resting heart rate (Mendelowitz, 1999). However, this pathway is immature at birth and undergoes a period of structural and functional maturation, becoming better integrated with other neural regions (see below). In the first months of postnatal life, myelinated vagus fibers increase in density and ratio compared to unmyelinated fibers, promoting improved efficiency of vagal signaling (Pereyra et al., 1992). These structural changes parallel the increasing functional influence of the vagus on the heart. Data from animal studies using cholinergic blockade, which directly disrupts vagal signaling, show that vagal influence on heart rate emerges around birth in sheep (Segar, 1997). Convergent data from studies with neonatal rats documents a maturational trend reaching adult levels by weaning (Larson & Porges, 1982). In humans, vagal influences are observed during the last trimester with increasing influence over the first postpartum weeks (Porges & Furman, 2011) and show increasing effect on the heart as the preterm infant approaches term (see Doussard-Roosevelt et al., 1997; Porges et al., 2019).

Though average heart rate is influenced by multiple simultaneous inputs, the direct activity of the vagus on the heart can be indexed by the amplitude of respiratory sinus arrhythmia (RSA), the fluctuations in the timing of heartbeats that occur over the respiratory cycle. In general, this gives rise to an increase in heart rate during inspiration and a decrease during expiration. RSA is one of the components of heart rate variability, which is sometimes quantified and conceptualized as high-frequency heart rate variability (Berntson et al., 1997). The moment-to-moment control of heart rate that is necessary for RSA is dependent on the myelinated vagal outflow from the nucleus ambiguous, with the myelination allowing for rapid changes in the firing of pacemaker cells. The measurement of RSA amplitude provides a reliable metric of vagal activity on the heart that can be directly compared across ages and populations. However, because the average respiration rate slows over the course of early childhood, using appropriate respiration frequency is critical for valid measurement (Berntson et al., 1997).

The increasing myelination and maturation of the vagal system is paralleled by increases in respiratory sinus arrhythmia over the first years of life (Alkon et al., 2011; Bornstein & Suess, 2000; Dollar et al., 2020; Izard et al., 1991; Porges et al., 1994). During this developmental stage, children vary in their trajectories of change, with rank-order correlations showing low to moderate stability (estimated range r = .3–.55; Dollar et al., 2020). This indicates a tendency to maintain patterns of resting parasympathetic activity over time, though there are deviations from trajectories that may indicate diversity in reorganization over the course of development. Though these resting levels of parasympathetic activity are comparable across ages, measures of reactivity are more difficult to directly compare due to lack of standardized socioemotional tasks that can provide consistent challenge throughout childhood. As children develop and their socioemotional, cognitive, and physical abilities expand and change, new tasks are needed that tap into capacity to regulate parasympathetic responses. Thus, not surprisingly, studies of age-related changes in parasympathetic reactivity to challenges have shown inconsistent results (Dollar et al., 2020). However, despite the challenges of describing variability in longitudinal trajectories, the maturation of the myelinated vagus and its integration with other brain centers allows for more flexible and controlled responses with age (Fracasso et al., 1994).

Sympathetic nervous system. The sympathetic nervous system (SNS) innervates many of the same organs as the parasympathetic division. This system is involved in triggering mobilization responses (e.g., "fight/flight"), emotional reactions, supporting metabolic activity during exercise, and maintaining homeostasis (such as controlling blood pressure). This multi-system control of individual organs permits fine-grained

regulation to meet nuanced demands (Jänig, 2022).

Sympathetic control of the heart can be measured by pre-ejection period (PEP), the time interval between ventricular depolarization and the beginning of ventricular ejection. Shorter time intervals reflect increased sympathetic activity (Berntson et al., 1994; Mezzacappa et al., 1999). Longitudinal studies of pre-ejection period suggest that resting sympathetic regulation of the heart decreases over childhood and adolescent development (Harteveld et al., 2021). In addition, there are several areas of sweat glands on the body that are innervated solely by sympathetic fibers. As these sweat glands open due to sympathetic activation, they increase the electrical conductivity of the surface of the skin (electrodermal activity; EDA; Dawson et al., 2007; Asahina et al., 2015). These two indices of pre-ejection period and electrodermal activity are commonly used metrics in development and parent-child interaction studies, with both indices being sensitive to changes in metabolic demands.

Autonomic Connections with Other Brain Regions Despite the anatomical parasympathetic and sympathetic divisions, contemporary models of the autonomic nervous system emphasize the integrated regulation of these branches to provide fine-grained coordination and graded metabolic responses (Jänig, 2022). The autonomic nervous system also interfaces with the hypothalamic–pituitary–adrenal (HPA) axis, a threat-responsive system influenced by early experience (Doom et al., 2014; Engel & Gunnar, 2020) that helps mobilize metabolic resources for threat response as well as sensitizing and shaping brain systems that support threat recall and activate threat responses (Herman et al., 2016). These multi-system responses are controlled by higher-level brain regions that are spread throughout the brain including the forebrain, midbrain, limbic structures, and neocortex.

The brainstem and spinal cord regions that support autonomic safety and threat responses are functionally connected with higher-order brain regions that integrate physiological information, maintain homeostasis, and are involved in reactions to threat (including the hypothalamus, the locus coeruleus, periaqueductal gray, and amygdala; Jänig, 2022). Interactions of the amygdala with the insula and ventromedial prefrontal cortex form a key component of responding to and controlling threat responses (Maroun, 2006). Though still developing in the newborn, amygdala connectivity with the insula and vmPFC are involved with fear expressions and fear development (Graham et al., 2016; Thomas et al., 2019). Affective regulative is also supported by the development of the amygdala–medial prefrontal cortex circuit, which is sensitive to input from the early environment (Tottenham, 2020). The PFC – which helps to down-regulate threat responses through connections with the amygdala – also shows experience-dependent structural development and functional connectivity (Hodel, 2018). These integrations between visceral autonomic state regulation, with regions supporting homeostatic process and threat regulation, form a foundation for effective communication between infants and their caregivers, as well as enabling learning about safety and danger signals over the course of development.

Theoretical Models of Autonomic Nervous System Development

The activity and regulation of the autonomic nervous systemAutonomic nervous system (ANS) develop over the lifespan, with some of the greatest structural and functional changes occurring over the first years. This development in the context of environmental differences can promote reorganization and tuning of the autonomic nervous systemAutonomic nervous system (ANS), promoting different trajectories of development. Individual variability in regulation and reactivity profiles can have implications for the tuning of threat responses and sociality and has implications for mental and physical health. In this section, we first review major theoretical models for the development of the autonomic nervous systemAutonomic nervous system (ANS), then review empirical work on how parent-child

dyadic interactionsDyadic and triadic interactions are implicated in the regulation and possible tuning of the autonomic nervous systemAutonomic nervous system (ANS) over time.

The Polyvagal Theory

The polyvagal theory (PVT) proposes that the autonomic nervous system is hierarchically organized based on the evolutionary emergence of different autonomic structures (Porges, 1995, 2007, 2021, 2022). In mammals, this includes two separate vagal pathways that have unique origins and emergent functions. From both evolutionary and developmental perspectives, the most recent vagal pathway emerges from an area of the brainstem that can be labeled as the ventral vagal complex (VVC). This brainstem area contains the source nuclei of motor fibers that regulate the striated muscles of the face and head, including the larynx and pharynx which control the acoustic features of vocalizations (Fig. 11.2). These pathways that are involved in controlling muscles are linked with the myelinated ventral vagal pathways that regulate the heart and bronchi. The shared linkage between the control of cardiovascular function with neural regulation of structures of the face and head are involved in coordinating the complex behaviors of sucking, swallowing, vocalizing, and breathing. These abilities are critical for human newborns, who rely on these capacities to feed, signal distress, soothe, and synchronize these actions with breathing. The PVT also posits that the coordination of these capacities facilitates socioemotional co-regulation and calm social engagement in the developing child and that disruptions to this system undermine state regulation which may lead with social learning and developing bonds (Porges & Furman, 2011).

The hierarchical system proposed by PVT is informed by principles of Jacksonian dissolution (Jackson, 1884), in which the disruption or inhibition of evolutionarily newer circuits facilitates the activation of older ones. It posits that when the VVC system is inhibited, older systems that promote defensive responses become activated in a hierarchical order. From the perspective of the polyvagal theory, social engagement is supported by robust and flexible activity of the ventral vagal system (which can be indexed by respiratory sinus arrhythmia). Inhibition of this function can facilitate sympathetic, fight-flight responses that may be felt as hypervigilance or anxiety, or – in the case of the oldest system – shut down and lethargy. Inhibition of the social engagement system promotes increased cardiac output necessary for behavioral mobilization including fight/flight behaviors, supported by the sympathetic nervous system. In most situations, the increased metabolic demands for mobilization are transitory, and the organism can rapidly return to a demobilized state once the behavior is completed. However, if the survival demands for mobilization are maintained for extended periods of time, it becomes metabolically costly, and the nervous system may adaptively respond by a neurogenic cardioinhibitory surge from an evolutionarily older system (Porges, 2007). The PVT proposes that these reactions are mediated through a dorsal vagal pathway with a distinct set of pathways arising from the dorsal motor nucleus of the vagus.

In infants who are born preterm, the ventral vagal pathway is immature and may thus confer risk of triggering danger-responsive circuits. High heart rate without respiratory sinus arrhythmia is common among preterm infants in the neonatal intensive care unit, a state that can be followed by life-threatening clinical bradycardia and apnea. In fetuses, transitory accelerations and decreases in beat-to-beat variability are predictive of heart rate decelerations (Reed et al., 1999). Through the lens of the polyvagal theory, without the state regulation of a functional ventral vagus, the preterm autonomic nervous system can become fixed in a mobilization state reflected in tachycardia (elevated heart rate). However, the metabolic costs of this extended mobilization state may result in a primitive shutdown reaction that is shared with ancestral vertebrates (e.g., reptiles and amphibia). Though these responses may have utility for other species, they may cause serious life threats in the context of the high oxygen needs of the mammalian brain.

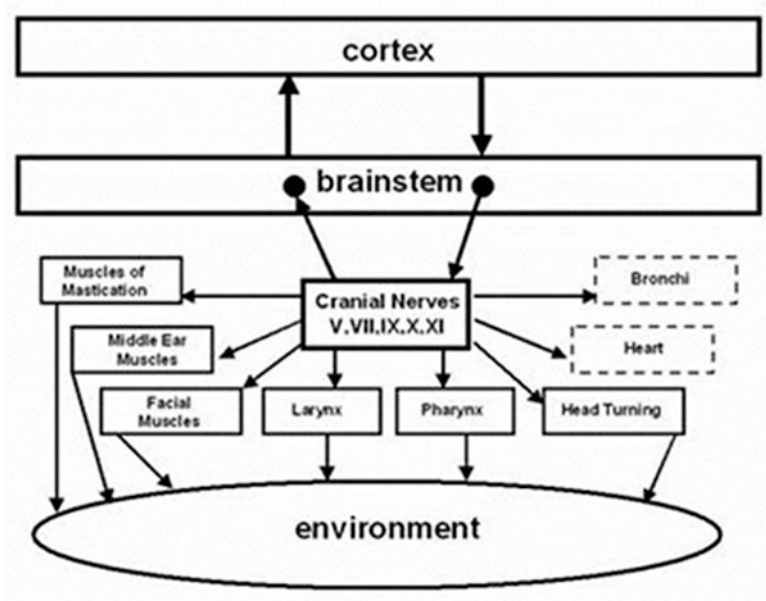

Fig. 11.2 The social engagement system model of physiological regulation links autonomic pathways (dotted boxes) with the muscles of the face and head that facilitate social signaling (filled boxes) in the brainstem. These linkages help to coordinate social expression and physiological state regulation during interactions. (Reprinted with permission from Porges, S. W. (2011, p. 56, Fig. 3.1). The polyvagal theory: Neurophysiological foundations of emotions, attachment, communication, self-regulation. New York: W. W. Norton, Inc. Copyright ©, Steven W. Porges)

Thus, when an adaptive immobilization survival reaction is triggered, the nervous system may become sensitized to freeze and behaviorally shut down; behaviors posited to be supported by a dorsal vagal circuit which has widespread innervation of the gastrointestinal tract and the enteric nervous system.

Over the course of development, safety and danger cues promote the infants increasing complexity and self-reliance in emotion regulation. This state regulation and capacity for co-regulation are proposed as being supported by the process of neuroception, a non-conscious system for detecting threats and safety cues in the environment (Porges, 2003, 2021). Subconscious safety cues that come from caregivers, peers, and the environment may help support physiological building blocks for bonding and attachment. In contrast, frequent danger cues have the potential to "tune" physiological regulation toward more sensitized and chronic threat response states that undermine attempts at calm social co-engagement (Porges, 2003; Porges & Furman, 2011). This tendency toward threat responses may cause risk for the development of behavioral profiles that are more attuned to respond to threats and the possibility of functional somatic disorders due to disruption of homeostatic maintenance mechanisms (Kolacz et al., 2019).

The Adaptive Calibration Model of Stress Responsivity (ACM)

The adaptive model of stress responsivity (ACM) is a model of neurophysiological state regulation that emphasizes how developmental plasticity is mediated and moderated by the stress response system – defined as the coordinated activity of the parasympathetic, sympathetic, and hypothalamic–pituitary–adrenal (HPA) axis activity (Del Giudice et al., 2011). Drawing on a life history strategy framework (e.g., Belsky et al., 1991), the ACM proposes that physiological stress responses

contribute to developmental trade-offs that determine how an orgasm prioritizes behavioral strategies based on its environment, which affect the contributions of both infants and their caregivers to dyadic co-regulation. Life history strategies can be described along a continuum of "slow" to "fast", spanning domains that include defensive behaviors, competitive risk taking, learning, attachment, and affiliation. "Slow" strategies are characterized by propensity toward stable pair bonds and enhancing long-term survival of oneself and offspring. On the other end of the continuum are "fast" life history strategies that are characterized by risk taking, a wider variety of mating opportunities, and producing more offspring with lower investment in individual children.

The ACM posits that the joint coordination of the stress response system, which includes autonomic activity, helps a developing organism encode and filter information about the social and physical environment (Del Giudice et al., 2011). Experiences of safety, stress, and danger are detected and encoded through the stress response system, shaping later physiological reactions. These experience-dependent profiles of physiological activation and reactivity promote behavior that supports responses to challenges and the capacity to benefit from the available social resources. This developmental process leads to adaptive behavior that is beneficial within the specific context in which the experiences occurred. For the purposes of this review, we focus on the aspects of the ACM related to the autonomic nervous system (for a detailed overview of all components of the stress response system and behavioral profiles, see Del Giudice et al., 2011). Consistent with Polyvagal Theory (Porges, 2007), the ACM predicts that more stressful or dangerous environments will reduce the activity and responding of the parasympathetic nervous system, though vagal augmentation in response to challenge has also been proposed as potential characterizing an unemotional profile (Ellis et al., 2017). In addition, it also proposes a non-linear association of environmental stress and sympathetic activity, wherein low stress settings tune the SNS to be reactive with rapidic capacity for recovery, which – in concert with the other components of the stress response system – may support sustained and flexible attention, sensitivity to social feedback, and a slow life history strategy with low risk taking and aggression (sensitive profile; Del Giudice et al., 2011; Ellis et al., 2017). Moderate stress is proposed to dampen the sympathetic activity and function to support a behavioral profile of low anxiety and aggression, balancing costs and benefits of social feedback (buffered profile). Dangerous or unpredictable environments are proposed to support a sympathetically dominated profile that promotes heightened threat attention and high trait anxiety (vigilant profile). Finally, severe or traumatic stress is proposed to result in stress response blunting across all components of the stress response system, promoting risk-taking and inhibited social learning (unemotional profile). These behavioral phenotypes are applicable to the contributions of both the child and caregiver to co-regulation.

Infants' experiences during caregiver interactions trigger stress response activation and regulation. The ACM posits that these patterns support adaptation to the environment by influencing the infants' behavioral propensities. Although the stress response system is still undergoing structural development in the first months of life (e.g., myelination of parasympathetic fibers that will facilitate it to become a rapid-acting system for regulating stress response, as reviewed above), these early life patterns of physiological activation may still promote the development of behavioral phenotypes. An environment with mild, predictable, and infrequent stress is expected to require rare sympathetic reactions and consistent, robust parasympathetic regulation. These infrequent stress triggers thus promote the benefits of responsivity without conferring significant health costs. Over time, this pattern is posited to promote social learning, affiliative interactions, and facilitate the capacity for social co-regulation with caregivers. In more harsh or unpredictable environments, heightened sympathetic reactivity and dampened parasympathetic activity confer advantages for maintaining safety and mobilizing resources to mount responses to danger. This

pattern is proposed to support the rapid mounting of mobilized danger responses at the cost of reducing sensitivity to social rewards, which can disrupt socialization opportunities with caregivers. In an infant with a limited behavioral repertoire for keeping oneself safe, these early signals of sensitized reactivity may occur in signaling distress cues to caregivers (e.g., crying). At the highest levels of danger, resource deprivation, threats to well-being, and unpredictability, the ACM proposes that blunted physiological stress responses support reduced sensitivity to both rewards and risks in the environment. This may provide protection from hostility and rejection at the possible cost of reducing responsivity to caregivers' affiliative bids. Because infants rely on caregivers to meet their physical needs, caregiver behavior at this time may be particularly significant for helping to shape infants' expectations about safety and predictability in the environment. However, environmental input to the stress response system will continue through childhood, with potential switch points occurring at important developmental transitions (West-Eberhard, 2003; Nelson et al., 2005).

Through the framework of the ACM, life history strategies also influence caregiver behavior and capacity for social physiological regulation. Caregivers whose physiological responses are optimized for relatively safe or mild stress contexts would be expected to support more "slow" life history strategies, with more investment in infant caregiving and greater physiological support for behavioral coordination with infants during play. In contrast, caregivers whose stress responses are more prepared for danger (i.e., vigilant phenotype) may be more prone to mount sympathetic responses based on their infants' cues and be less attentive to affiliative social bids. Caregivers with blunted threat responses optimized for reducing social input from the environment may be inhibited from coordinating their physiological responses with their infants and may invest less in child care.

In opposition to models that posit stressors as promoting psychopathology, the ACM instead emphasizes that environments help shape adaptive responses for conditions under which development occurred (Ellis & del Giudice, 2019). Although certain behavioral phenotypes that support a slow life history are more conducive to offspring care, a broad range of infant and caregiver behavior may be beneficial depending on context. For example, vigilant phenotypes may help a caregiver to maintain a child's safety in dangerous environments. Through the lens of the ACM, problems may arise from mismatch between either infant or caregiver and current environment. These may arise when prior environmental cues under which stress responsivity was shaped were a poor predictor of current conditions. In addition, there are evolutionary limitations to adaptation. Mismatch may also arise when key elements of the environment were not encountered over the course of evolutionary history, in which case the developmental plasticity repertoire not adequately support adaptation.

Integration of Visceral State Regulation with Social Signaling

Observational longitudinal studies provide evidence supporting theoretical models that vagal regulation plays a role in children's socioemotional adjustment. For example, more flexible vagal withdrawal during a challenging assessment in late infancy predicts lower rates of social withdrawal and aggression at 3 years of age (Porges et al., 1996). In addition, children whose vagal tone increases more rapidly over the course of 6–12 months have faster increases in social coordination during interactions with caregivers, marked by greater joint focus of attention and mutual contribution to play (Porter et al., 2022). In contrast, children who plateau in their RSA growth trajectory from infancy to toddlerhood have more difficulties in parent-reported social responsiveness later in age (Patriquin et al., 2014).

Data from experimental studies are emerging to demonstrate that parent behavior and state regulation are important factors in children's autonomic responses. In a study of the effects of

maternal stressors on infant autonomic regulation, mothers who were randomized to receive a negative evaluation of their prepared speech had stronger SNS increases (measured by pre-ejection period), compared to positive evaluation and a condition in which they delivered a speech to no judges (Waters et al., 2014). Upon reunion with their infants after the evaluation, the infants whose mothers received the negative feedback had greater heart rate acceleration, compared to the control condition (Waters et al., 2014). In addition, interventions that alter children's caregiving environment and improve caregiver sensitivity elicit improvements in children's autonomic activity. This is demonstrated in early childhood (Hastings et al., 2019) and infants who are born preterm with compromised ability to regulate their autonomic state (Porges et al., 2019; Welch et al., 2020).

The vagus, in addition to its function as part of the parasympathetic division of the autonomic nervous system, also includes somatomotor components that innervate the larynx and pharynx. Both the autonomic and somatomotor components of the vagus have outflow that arises from the nucleus ambiguus, the brain region that has strong control over heart rate (see above). This anatomical connection facilitates a viscera-voice connection that links the functional vocal expression with internal state and allows for the close coordination of speech with breath control. It has been proposed by the polyvagal theory that this functional integration is also shared with other cranial nerves that control the facial muscles, muscles of head-turning, middle ear muscles (which facilitate the extraction of vocalizations from background noise), and muscles of mastication (1995, 2001, 2007). The increasing maturation of the vagal system in the first months of life scaffolds the increasing social repertoire and linkage of the autonomic nervous system with social signaling (Porges & Furman, 2011; Mulkey & du Plessis, 2019). Coordination between social interactions with caregivers and autonomic state regulation has been explored in research on vocalizations and touch.

Co-regulation Through the Voice

One type of co-regulation patterns that link autonomic states with social behavior is in the expressive acoustic features of vocalizations. At birth, infants have a repertoire of simple vocal cues such as cries and coos that signal their states to caregivers. Caregivers, on the other hand, use a range of vocalizations with their caregivers including speech and song that reflect their states and serve as modulators of infant autonomic states (Cirelli et al., 2018, 2020). For both infants and caregivers, vocal production depends on the neural coordination of multiple structures innervated by cranial nerves and linked via brainstem regions to autonomic vagal pathways. Most vocalizations are produced through the aerodynamic energy released from the lungs. As exhaled air passes through the vocal folds, the shape and tension of the folds are modified by laryngeal muscles, which convert the air to audible sound. As the modified airflow travels further along the vocal tract, it is augmented by the dynamic movement of the pharyngeal muscles that line the throat, the tongue, the opening of the mouth, and the lips. The neural control of the laryngeal and pharyngeal muscles arises from the projections of the vagal complex in the lower brainstem (comprising the vagus and glossopharyngeal nerves; Lester et al., 1990). These projections provide control over the features of vocalizations that are interpreted by an interaction partner including pitch, volume, resonant frequencies, frequency modulation, and temporal patterning (Lester, 1984; Fitch, 2006; Honda, 2008; Roy et al., 2009; Hoh, 2010).

The muscles that control the larynx and pharynx are linked to autonomic activity through their integration in the brainstem. Autonomic shifts in response to physical and psychological stressors (such as changes in heart rate and blood pressure) co-occur with muscle tension changes in the intrinsic muscles of the larynx in adults (Helou et al., 2013, 2018) that affect the features of vocalizations. These physiological changes link acoustic features with autonomic state. In infants, withdrawal of cardiac vagal tone during the

severe stress of circumcision was paralleled by an increased cry pitch (Porter et al., 1988). This functional integration of modulation of vocal features with autonomic state in infants and their caregivers produces a channel for co-regulation of state, in which internal autonomic states can be reflected in vocal signals, interpreted by listeners, and provoke responses.

These acoustic features are related to the perceptions and autonomic responses of caregivers. For instance, adults rate infant cries as more arousing and aversive when they are higher in pitch and have more high-frequency power (Zeskind & Marshall, 1988; Gustafson & Green, 1989) or when they have shorter pauses which are indicative of faster breathing (Zeskind et al., 1992). These acoustic features would all indicate a more urgent infant arousal state marked by tension of the laryngeal and pharyngeal muscles that produce higher frequencies and shorter pauses which reflect more rapid breathing.

Parent perceptions and reactions to infant vocalizations help to promote state regulation and prime behavioral responses. In both mothers and fathers, stronger negative emotional reactions to infant cries are associated with brain activation patterns that suggest distress and challenges with emotion regulation (Laurent et al., 2011; Musser et al., 2012; Li et al., 2018). These responses to infant cues may shape behavioral co-regulation patterns and parenting behavior. For instance, elevated skin conductance responses (indicating sympathetic arousal) to a standardized infant cry paradigm by mothers of 3-month olds predict harsh discipline at 12 months (Joosen et al., 2013).

The dynamics of mother vocalizations with infant biobehavioral state have been demonstrated in freely interacting dyads who had just completed an emotional challenge (Kolacz et al., 2022). In the study, mothers' speech was assessed using an automated method that quantified strong mid frequencies, weak high frequencies, and greater spectro-temporal modulation as indicative of acoustic safety signals based on listening bands and safety/danger signals (Porges & Lewis, 2010; Kolacz et al., 2018). When socially re-engaging to soothe their infants after the stressor, mothers whose speech had acoustic features that matched a more safety communication profile were more likely to have their infant slow their heart rate and reduce behavioral distress. These safety-related acoustic features also predicted stronger vagal calming of the heart in infants whose vagal regulation was weak during the stressor. Bi-directional path analysis also showed that changes in maternal prosodic features were predicted by infant heart rate, with high infant heart rate predicting increases in mothers' prosodic features, suggesting that mothers adjusted the features of their voice in response to infant's arousal state.

In sum, infant and caregiver co-regulation is supported by vocalizations, which communicate internal states and affect the physiological states of listeners. These emotional aspects of vocalizations are part of social repertoire early in life, providing a channel for coordination of interactions.

State Regulation and Touch

The role of touch in affective co-regulation in early life development is supported by experimental studies. Animal studies show that tactile maternal behavior like licking and grooming can profoundly impact long-term behavioral trajectories, gene expression, and diversity in brain morphology (Zhang & Meaney, 2010). Pathways that transmit tactile information are integrated with autonomic regulation (Craig, 2009) and are particularly sensitive to the developmental input of touch early in life (Koch & Fitzgerald, 2013). In human newborns, gentle skin stroking activates the postcentral gyrus and the posterior insular cortex, regions linked to both somatosensory and socio-affective processing (Tuulari et al., 2019). The activation of the insula is more pronounced for slow, rather than fast stroking and show similar patterns to adult brain tactile responses (Jönsson et al., 2018).

Thus, touch may be an important component of co-regulation between infants and their caregivers. Infants whose mothers were randomized to maintain touch during the Still Face – a dyadic stressor in which parents are instructed to keep a

blank face and be unresponsive to the infant – had infants with attenuated vagal withdrawal, compared to those who were instructed to perform the Still Face without touch (Feldman et al., 2010). Touch has also been used as an intervention to support infant's state regulation. Kangaroo Care, an intervention method of holding children with skin-to-skin contact on an adult's chest, is now widely implemented for preterm infant care. Because vagal pathways are less mature before full-term gestational age, preterm infants may be at risk of difficulties with parasympathetic vagal regulation (Mulkey & du Plessis, 2019). Preterm infants who receive skin-to-skin care in the early weeks of life show more mature vagal tone and more mature state regulation (longer quiet sleep and alert wakefulness states) compared to their peers (Feldman & Eidelman, 2003). Combining maternal singing with Kangaroo Care increased high-frequency heart rate variability in preterm infants and reduced maternal anxiety, compared with Kangaroo Care only (Arnon et al., 2014).

Influences on Caregiver-Child Co-regulation Patterns

Adults' autonomic functioning is influenced by their own history, which has implications for social interactions and co-regulation with their children. Adversity experiences may re-tune the autonomic nervous system toward more threat-responsive states. It has been proposed that adversity can be described among two distinct dimensions: threat and deprivation (McLaughlin & Sheridan, 2016). However, because young children rely on their caregivers for their basic survival needs such as nutrition, the distinction between these domains is blurred in early life (Leneman & Gunnar, 2018). Thus, direct deprivation of care may pose a significant survival threat that spans distinctions between threat and neglect.

A large body of literature has shown post-traumatic stress disorder is associated with weaker vagal regulation (Chalmers et al., 2014; Schneider & Schwerdtfeger, 2020) and heightened sympathetic responses (Pole, 2007). Threat-responsive profiles of autonomic activity can disrupt typical homeostatic functions that maintain body functions (Sterling, 2012; Billman, 2020). These disruptions can manifest in physical symptoms both in visceral organs and in organs regulated by somatomotor innervation (such as the muscles of the larynx and pharynx). In a sample of adults (Kolacz et al., 2023), the severity of somatic dysfunctions was associated with sensor-based measures of parasympathetic and sympathetic activity. Those with minimal or no symptoms showed the most well-regulated autonomic responses – with coordinated mobilization to a physical challenge across parasympathetic and sympathetic indices and return toward baseline levels after completion. Moderate levels of symptoms were associated with extended sympathetic activation and the very highest levels were associated with poor overall coordination between systems. These findings demonstrate that disrupted homeostatic function can be caused by underlying autonomic profiles that can reflect more threat-responsive patterns (such as extended sympathetic arousal).

Autonomic shifts toward heightened threat responses can impact the social co-regulation of states between parents and children. In a meta-analysis of studies on mother-child parasympathetic synchrony (i.e., simultaneous changes in activity over the course of interaction tasks measured by RSA), synchrony in dyads was reduced in samples that were characterized by high risk (clinical difficulties such as maternal depression, socioeconomic disadvantage, or child maltreatment exposure) (Miller et al., 2023). These patterns of synchrony may have an influence on the development of children's emotion regulation development. For instance, infants' emotional regulation improved over the course of a challenging task when their parasympathetic activity was coordinated (Abney et al., 2021).

Summary and Key Points

The autonomic nervous system assists both stress responses and sociality which help to coordinate long-term development. The plasticity and rapid

experience-dependent maturation of the autonomic nervous system in infancy highlights its potential for supporting mental health related to safety and threat response over the course of development. Theoretical models emphasize that the regulation of the autonomic nervous system over the course of development primes stress responsivity, safety and danger responding, and capacities for social co-regulation. Environments that are rich in safety and co-regulation opportunities provide experiences with effective transitions between stress, threat, and safety states. These experiences can shift physiological propensities toward safety-related social function and decrease the probability of chronic threat response states, promoting attunement to affiliative interactions and social learning.

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12 Adrenocortical Reactivity in Infancy and Early Childhood: Allostatic Function as Flexibility, Attunement, and Coordination

Leslie Atkinson, Jennifer Khoury, Brittany Jamieson, Jaclyn Nofech-Mozes, and Andrea Gonzalez

This chapter reviews hypothalamic-pituitary-adrenocortical (HPA) reactivity in early life (infancy to preschool) *as an allostatic function*. We define HPA reactivity in terms of cortisol response to laboratory and other brief challenges. The central feature of allostasis involves physiological change in preparation for environmental contingencies (Peters et al., 2017; Sterling, 2012; Sterling & Eyer, 1988). Allostatic load, the long-term, systemic wear and tear under repeated or chronic challenge, represents the cost of this process (McEwen, 1998). Here, we isolate three fundamental aspects of allostasis and allostatic load – flexibility (the capacity to adjust physiological function in anticipation of changing environmental conditions), attunement (the degree to which caregiver and child physiologies covary), and coordination (the extent to which stress physiology systems harmonize with one another).

We review these considerations because of a paradox respecting the allostasis construct. On the one hand, allostasis is considered synonymous with the stress response itself (Peters et al., 2017); on the other, "doubts persist about [the] precise meaning [of allostasis] and whether it is useful" (Schulkin & Sterling, 2019). Six points are relevant in this regard: (1) Confusion remains regarding differentiation of allostasis and homeostasis (Schulkin & Sterling, 2019); (2) allostasis is often defined and operationalized restrictively as pertinent only to physiological adaptation in the face of environmental change (3) but not measured accordingly (Atkinson et al., 2016), and (4) attunement and coordination are rarely acknowledged as central to the allostatic construct in research papers. So, studies often assess anticipatory function (flexibility) only indirectly, neglect the infant's utter dependence on his/her caregiver and the reciprocity of their physiological influence (attunement), and measure physiological function one stress system at a time

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(coordination, with implications for the allostasis-homeostasis distinction).

Moreover, (5) each of these processes (flexibility, attunement, coordination) represents a dimensional metric of HPA function in and of itself, with unique and shared correlates beyond those assessed by traditional metrics (e.g., point estimates, change scores, areas under the curve (AUC), and trajectories). HPA flexibility, attunement, and coordination are reviewed elsewhere (Atkinson et al., 2016). Here, we reframe, update, and elaborate them so as to encourage their use as metrics, as dependent and independent variables in their own right, singly and in combination.

In this regard, we review each of cortisol flexibility, attunement, and coordination *as moderated* processes to show patterns of agreement across studies. Each of these processes is moderated by features of the child and their history. For example, one would not expect an infant from a violent home to react to a 2-minute arm restraint or a noise burst in the same way as a child from a beneficent one. Similarly, a child with experience of neglect will probably respond to repeated, brief parental separations differently than a child from a more responsive household. Comparable reaction of these children to parental departure would violate allostatic principles regarding prediction based on past experience. Such considerations indicate the importance of *meaning*, of matching challenge to sample, an issue that is likely buried in mean cortisol reactivity statistics and neglected in the literature. Likewise, one would not expect a highly reactive child, either by virtue of temperament or environmental disadvantage, to respond comparably to an impassive child. The same can be said of the challenges themselves; some will produce greater reactivity than others (as reviewed below), again, depending on the sample under consideration, or the stress system being examined, such that the use of multiple challenges presented to a single sample may usefully detect variability of response as appropriate to the challenge. Respecting the measure of coordination among stress systems, it is a moderation paradigm by definition, with physiological systems co-regulating one another. Issues of moderation are not only intrinsically important to understanding HPA development, but their integration into research design is crucial where ethical considerations dictate the use of relatively benign lab challenges. The study of moderation by child and family features, the nature of lab challenges, and stress systems likely magnify the relatively weak cortisol response signals generated by necessarily feeble lab challenges. Again, for these reasons, we focus here on the meaning of interactions, not main effects, in the measure of cortisol responsivity.

Finally, we return to the basics of allostasis because (6) misinterpreted findings partially drive theory, indicating a need to revisit fundamentals. The influence of artifacts on theory is implied by research that demonstrates the differential impact of varied laboratory stressors in activating cortisol excretion (Dickerson & Kemeny, 2004; Gunnar et al., 2009; Jansen et al., 2010; Puhakka & Peltola, 2020). For example, Gunnar et al. (2009) found that in the 12- to 24-month and 2- to 5-year age ranges, only 20% and 9% of studies, respectively, showed mean cortisol increase in response to laboratory challenge. Researchers hypothesized that such data reflect the diminution of adrenocortical function during these latter years, and proposed that this effect may protect the developing brain from cortisol toxicity. While acknowledging the role of neurodevelopmental and psychosocial maturation, however, Gunnar et al. (2009) suggested that "developmental changes in stressor paradigm effectiveness undoubtedly relates to our lack of understanding of the psychological processes critical to eliciting a stress response of the HPA axis in children of different ages" (p. 954). When artifact drives theory, there is a need to return to basics, review findings, and augment present metrics with alternative measurement approaches.

Flexibility, Attunement, and Coordination

Flexibility The core tenet of the allostasis construct is that "efficient regulation requires *anticipating needs and preparing to satisfy them before*

they arise" (Sterling, 2012, p. 5, italics added). This contrasts with the traditional regulatory model, homeostasis, which aims at reactive preservation of physiological constancy around some setpoint (Sterling & Eyer, 1988). Sterling and Eyer pointed out that homeostatic processes cannot explain the extreme diurnal fluctuation of physiological systems nor the physiological changes needed to meet changing circumstances. In order to achieve stability, "an organism must occupy each of these different states and move flexibly between them" (p. 633).

Although Sterling (2012; Sterling & Eyer, 1988) initially considered allostasis the "primary" regulatory mechanism, with homeostasis playing a subservient role, it is now theorized that allostasis and homeostasis work in tandem; allostatic predictions can be wrong and homeostatic systems may correct resultant errors (Schulkin & Sterling, 2019). At any rate, allostasis is likely more active as an organismic process in the context of psychosocial function, whereas homeostasis may work at the level of individual organs and tissues, particularly as they are studied in vitro or in anesthetized animals, where demand is relatively invariant (Sterling, 2012; Sterling & Eyer, 1988). For this reason, and because (a) allostasis better links environmental contingencies to coordinated physiological function as orchestrated by the central nervous system, (b) allostasis has advantages over homeostasis from an evolutionary perspective (Sterling, 2012; Sterling & Eyer, 1988), and (c) adrenocortical function is better understood as an allostasic phenomenon (Peters et al., 2017), we focus largely on allostasis, using homeostasis as a counterpoint.

As mentioned, the allostasis model was expanded to incorporate "allostatic load" (McEwen, 1998). Healthy stress reactivity involves mounting a robust response where appropriate, then downregulating in timely manner; such a response shows physiological elasticity. But repeated or chronic stress eventually results in weakened response, and/or failure to recover (McEwen, 1998); these responses, representing high allostatic load, show lack of pliability, a failure to accommodate or titrate physiology to context. Despite the centrality of allostasis to the fuller understanding of stress physiology, and the centrality of flexibility to allostasis, research paradigms are not necessarily designed to assess these features, with some laboratory challenges provoking response, albeit emaciated, others not.

This disregard of challenge features predates the allostasis model, a possible holdover from homeostatic models, which reflect emphasis on the "universality" of the stress response, the notion that stress responses are similar, regardless of the stressor (Selye, 1956). Ultimately, it was recognized that this emphasis was misplaced, with physiological reactivity importantly dependent on the nature of the stressor. Nevertheless, this universalist tradition continued in the study of adrenocortical function, although that tradition ended with the publication of several reviews pinpointing the differential efficacy of challenge type. Thus, Dickerson and Kemeny's (2004) meta-analysis showed that many adult laboratory challenges fail to produce the expected cortisol increase. In their systematic review incorporating infant, child, and adolescent samples, Gunnar et al. (2009) showed that 80% of challenges presented to 12- to 24-month-olds were ineffective in eliciting cortisol change. Jansen et al. (2010) conducted a systematic review with effect sizes among samples aged 0 to 52 weeks. Acute stressors included mild physical challenge (e.g., medical examination, weighing, diaper change), pain (healstick, vaccination), separation from caregiver, anger induction (e.g., deprivation of attractive toy), fear induction (e.g., exposure to spider, mask, robot), and novelty. Mean pre- to post-challenge cortisol response corresponded to an effect of $r = 0.39$ at ages 0 to 13 weeks, $r = 0.26$ at 3 to 6 months, $r = 0.07$ at 6 to 12 months, and $r = 0.04$ at 12 to 24 months. Jansen et al. (2010) concluded, "acute stressors provoke a small to moderate cortisol reaction only in infants younger than 6 months. After 6 months of age, mean cortisol reactivity effect sizes are lower than $r = 0.1$, signifying no effect" (p. 331). Gunnar et al. (2009) concluded similarly: "all too often, the stressor paradigms do not provoke cortisol in all, or even most, of the children." The Puhakka and Peltola (2020) meta-analysis also showed small

effect (g = 0.11; corresponding roughly to r = 0.06 – current authors' transformation) across early life laboratory (0–18 month) stressors. This failure to generate a strong signal masks both cortisol reactivity and return to baseline (pre-challenge) levels, core features of allostasis as the infant anticipates changing circumstances. Of potential utility to the measure of flexibility, however, all meta-analyses showed substantial effect size variability, both between participants and across challenges. With data on the variable potency of laboratory challenges comes the potential to exploit different challenge *combinations* to address the central feature of allostasis, operationalized here as within-participant response flexibility *across* challenges (Atkinson et al., 2016).

In our own work, we exploited the review-based findings that challenges involving emotion provocation typically fail to evoke cortisol responsivity in early life but that separation challenges more consistently elicit cortisol increases. Thus, Jansen et al. (2010) found that fear and anger challenges produced effects of d_z (standardized difference between pre- and post-challenge cortisol concentrations) = −0.09 and 0.13, respectively (corresponding to rs of −0.045 and 0.065); in comparison, cortisol response to maternal separation corresponded to an effect of d_z = 0.34 (or r = 0.17). Similarly, Puhakka and Peltola (2020) found a single moderator in their meta-analysis of infant stress reactivity – laboratory challenge. Of particular relevance, they reported that infant response to separation challenges emerged as the only significant effect (g = 0.15 or $r \cong$ 0.075) and that frustration paradigms failed to induce a cortisol response altogether (g = −0.004, or $r \cong$ −0.002). All effects are small, as is consistent with ethical principles respecting experimentation with children, but the differences are significant (Puhakka & Peltola, 2020).

Accordingly, we assessed low-risk, community dyads in a frustration procedure, administered at toddler age 16 months, wherein mother repeatedly blocked her child's access to an appealing new toy; this frustration paradigm served as the low-stress, "baseline" condition. We also administered a maternal separation procedure at 17 months in the lab, as the more provocative adrenocortical challenge. We found that infants with more sensitive mothers mounted a stronger cortisol response to the separation challenge, and showed more efficient downregulation in response to the frustration task, than did infants with less sensitive mothers. Results are reproduced in Fig. 12.1, demonstrating several key points (Atkinson et al., 2013).

First, the frustration task did not precipitate a mean cortisol increase in mothers or infants. On the contrary, there was a mean decline across participants. By comparison, mothers showed a mean decline in cortisol level in the Strange Situation Procedure, while infants of more sensitive mothers showed an increase, and infants of less sensitive mothers showed significantly lesser elevation. These findings show that the challenges were appropriately selected because (a) the frustration procedure is not designed to elevate cortisol levels, and (b) the separation procedure is designed to provoke a cortisol response in infants, but not in adults.

Second, and most importantly, infants of more sensitive mothers showed greater adrenocortical *flexibility* than infants of less sensitive mothers. Specifically, infants of more sensitive mothers displayed more robust upregulation of HPA activity than infants of less sensitive mothers in the context of threat, and faster and more complete downregulation in the low-threat context, as compared to infants of less sensitive mothers. This is a clear demonstration of allostasis. As Sterling (2012; Sterling & Eyer, 1988) pointed out, the organism does not struggle to re-establish initial balance in response to change, but to establish a homeostasis consistent with the challenge at hand. Figure 12.1 shows that children with less sensitive parents lack the adrenocortical flexibility to do this efficiently. To varying degrees, this loss of flexibility depicts what Sterling and Eyer (1988) described (in the context of homeostasis, actually) as a "'fixed capacity'… excessive for smaller loads … but insufficient for larger loads (p. 2)." This is the cost represented by allostatic load.

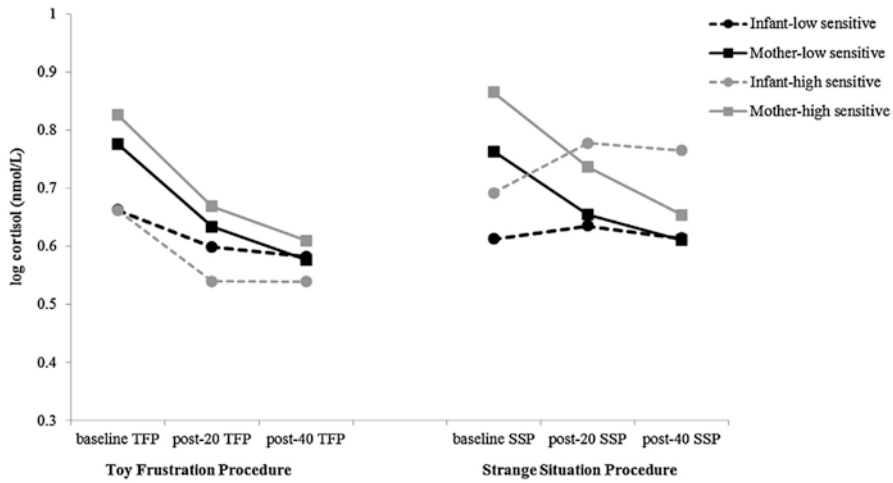

Fig. 12.1 Mean mother and infant cortisol levels across challenge by maternal sensitivity. (Note: *TFP* toy frustration procedure, *SSP* strange situation procedure. From Atkinson et al. 2013. Reproduced with permission. Copyright Elsevier)

Third, mean baseline cortisol levels are uniformly high for mothers and infants. This is obvious in the frustration procedure, where all means drop below baseline levels, but it is also true for the Strange Situation Procedure, where mean baseline levels are comparable to those shown in the frustration procedure and where maternal means decline beyond baseline levels. It is important to note with respect to high baseline levels that we informed mothers pre-visit that their infants would be subjected to mild stressors. Therefore, we attributed these relatively high baseline levels to "arrival effects," or *anticipatory* anxiety, a commonly observed phenomenon (Ludmer Nofech-Mozes et al., 2020). We suggest here that the evidence of anticipatory anxiety validates a central allostatic principle: the organism *predicts* change and prepares for it. Furthermore, the decline in cortisol levels successive to baseline, where this is evident in Fig. 12.1, is consistent with participant re-evaluation of context and further anticipatory adjustments. Moreover, the blunted cortisol decline among toddlers with lower-sensitivity mothers in the low-stress paradigm may indicate their anticipation of further demand (Ganzel et al., 2010; Sterling, 2004), either because the toddler does not expect assistance from their mother, based on past experience, or because interaction with her is stressful in itself; even loss of allostatic flexibility may be adaptive as a secondary recourse in trying environments. In this regard, it is noteworthy that infants of mothers with disrupted communication (Crockett et al., 2013) and toddlers classified as attachment disorganized (Ludmer Nofech-Mozes et al., 2020), both reflecting extreme parenting challenges and potential threat (as described below), showed their highest levels of cortisol when other children (of mothers with less disruptive parenting or nondisorganized attachments) were showing recovery (baseline) levels.

We (Ludmer et al., 2015) replicated this flexibility finding in the context of maternal depressive symptoms and targeted toddler genes using the sample described above (and controlling for maternal sensitivity), based on the following rationale. Maternal depression is linked to infant adrenocortical dysregulation, likely via genetic, epigenetic, and psychosocial means. This typically involves unusually high cortisol levels, which may become blunted by chronic stress, possibly in response to social stressors in particular (Klimes-Dougan et al., 2022). Some studies indicate that the offspring of a parent with depression fail to show timely return to cortisol baseline

levels, reflecting impaired "flexibility" (Klimes-Dougan et al., 2022, p. 2). This is noteworthy in the context of depressive symptomatology because adrenocortical function likely serves a significant role in the transgenerational transmission of depression (Klimes-Dougan et al., 2022).

However, not all research confirms the association between maternal depressive symptoms and atypical adrenocortical function in early life, indicating potential moderation of this effect (Klimes-Dougan et al., 2022). Important among potential moderators are dopamine and related genes. As reviewed elsewhere (Ludmer et al., 2015), neonates of mothers with depression often have lower dopamine levels than do neonates with nondepressed mothers, which is crucial to the physiology of depression, in part via regulation of HPA function. In addition, dopamine plays a role in parenting behavior (Mileva-Seitz et al., 2012), itself linked to child HPA function. More broadly, dopamine is afforded a central shaping role in the mechanism of allostasis, particularly as this pertains to social organization (Sterling, 2012); pulses of dopamine may reinforce unexpectedly accurate predictions of change, thereby increasing the probability of future effective regulatory behaviors (Schulkin & Sterling, 2019).

We evaluated the interactive impact of maternal depressive symptoms and toddler dopamine-related genes (*SLC6A3, DRD2*) on child adrenocortical flexibility across frustration and separation procedures (Ludmer et al., 2015). We found that toddlers with susceptibility genotypes, who had mothers with high depressive symptomatology, showed weaker cortisol decline in the Toy Frustration Procedure, and weaker increase in the Strange Situation, than did other toddlers, i.e., those with susceptibility genotypes *and* mothers higher in depressive symptomatology showed decreased flexibility across challenges.

Although the flexibility findings described above were replicated four times (across maternal sensitivity and maternal depression as moderated by each of *DRD2* and *SLC6A3*), all findings are based on the same sample, challenges, and stress system. There is need for replication, but the paradigm is promising.

Attunement

Sterling (2012; Sterling & Eyer, 1988) founded the allostasis construct on the insight that morbidity and mortality rates are linked to the disruption of intimate social relations in humans and other primates. Human physiology must support the species' altricial nature, itself prerequisite to evolutionary success (Byrd-Craven & Clauss, 2019). Humans are born utterly dependent on their caregivers, and social engagement (and allostatic load) mediate the impact of early social adversity on (multi)morbidity across the lifespan (Atkinson et al., 2023). The centrality of interpersonal relations is universally acknowledged in life course models, including socio-emotional, sociocultural/cognitive, geroscientific, psychoevolutionary, and biological-evolutionary theories (Atkinson et al., 2023). Several models address the issue of biological attunement in the context of caregiver–child relations. The mutual regulation (Gianino & Tronick, 1988), adaptive calibration (Del Giudice et al., 2011), and biobehavioral synchrony (Feldman, 2012) models emphasize reciprocally coordinated dyadic function as it mediates between social signals and biological response to regulate physiology, emotion, and behavior. All these models are consistent with allostatic propositions.

Attunement crosses individuals and systems, as when the caregiver's behavior covaries with the child's physiological response, and across individuals but within systems, as in the covariation of caregiver and child biological functions. This covariation is described by a proliferation of terms (DePasquale, 2020; Di Lorenzo et al., 2022) and has been studied across, e.g., behavioral, emotional, communicative, and physiological domains (Atkinson et al., 2016; Provenzi et al., 2018). The rich theorizing, expansive nomenclature, and broad usage reflect definitional (DePasquale, 2020; Provenzi et al., 2018), measurement (Khoury et al., 2015), and analytic (Di Lorenzo et al., 2022) uncertainty, but also the concept's extreme heuristic value. Here, we define attunement in its broadest terms, simply as the covariation between mother and child cortisol excretion; this allows us to review studies that

rely on bivariate correlational approaches and convergence statistics, as well as well as those that adopt actor-partner and cross-lag analyses, etcetera. However, we also attempt to determine when covariation may not reflect the reciprocal influence of parent on child. We recognize that different analytic strategies address different questions (Ludmer Nofech-Mozes et al., 2020), as pointed out by Bernard et al. (2017), and well-reviewed by Di Lorenzo et al. (2022). However, we see value in assessing replicability across multiple approaches to ensure that findings are broad-based and not artifactually confined to a single definition, metric, or analytic strategy.

Attunement likely "supports neurobehavioral maturation, shapes the ability to handle stress, and organizes the child's lifetime capacity for social affiliation and the ultimate ability to provide adequate parenting in the next generation" (Feldman, 2012, p. 155). It is hypothesized (but rarely demonstrated within the adrenocortical attunement literature) that where dyadic systems go amiss, so too do emotional, behavioral, cognitive, and physical development (Del Giudice et al., 2011). "Health happens between people" (Maunder & Hunter, 2015, p. 5).

To be sure, there are studies that did not show significant attunement between caregiver and child cortisol levels. Most recently, Bader et al. (2021) found significant correlations between mother and infant, and father and infant cortisol point estimates assessed at baseline, post-Strange Situation, and recovery. However, these relations dissipated to nonsignificance when within-partner effects (e.g., mother stability, infant stability) and cross-lagged paths were covaried. Therefore, Bader et al. proposed that prior attunement findings may be spurious. These data present an important challenge to the concept of cortisol attunement and should be further investigated. However, beyond difficulties in the interpretation of null findings, particularly where a small sample size is concerned, studies of cortisol reactivity that fail to demonstrate significant main effects nevertheless overwhelmingly reveal significant moderation (Atkinson et al., 2016). Mean levels of cortisol attunement obscure interdyadic variability (Kalomiris & Kiel, 2018; Laurent et al., 2011). Thus, Davis and Granger (2009) attributed their null findings regarding mother–infant cortisol attunement across multiple well-baby exam/inoculation procedures to an unmeasured moderator, specifically, maternal sensitivity.

Below, we focus on statistical interactions as they predict parent–child cortisol attunement. Consistent with the social emphasis of the allostasis construct, investigators have largely focused on cortisol attunement as moderated by maternal/family features, including maternal sensitivity, disrupted maternal communication, restrictive and punitive parenting, maternal depression, inter-partner violence, and maternal history of maltreatment. Child moderators encompass attachment disorganization, emotion- and self-regulation, temperament, and preterm birth.

Positive Parenting Studies consistently show moderated effects linking parenting to mother–child cortisol attunement. Provenzi et al. (2019) found correlated mother–infant values at 3 months corrected age (observed in the Still Face) among full-term mother–infant dyads; no correlations were significant in the case of very preterm infants and their mothers. This may reflect the fact that early HPA function "is not an immature version of the adult social buffering system and is adapted to unique features of the mother–infant dyad" (Hostinar et al., 2014, p. 53). For example, the prefrontal cortex, profoundly involved in regulating adult HPA activity, remains underdeveloped in early life. Even at this stage, however, attunement may be manipulable via social intervention. Neu et al. (2009) showed a significant decrease in the discordance between the cortisol levels of premature infants and their mothers after, as opposed to before, mothers held their infants. Mörelius et al. (2012) randomly assigned preterm dyads to almost continuous skin-to-skin contact and standard care conditions. They found greater cortisol attunement in the former, as compared to the latter, but the difference only approached significance ($p < 08$; computation by current authors), possibly due to small sample size ($N = 23$ and 19,

respectively). Cristóbal Cañadas et al. (2022) showed significant cortisol declines among preterm infants and their mothers randomly assigned to a skin-to-skin contact group, but the same findings did not emerge in the lower-contact control group. So again, mother–infant cortisol attunement is lower among preterm dyads, although physical contact appears to increase attunement levels.

Sethre-Hofstad et al. (2002) conducted a study of attunement involving two- to four-year-old children recruited from the community. They found a strong, significant (partial) correlation between mother and child cortisol change scores in response to a child balance beam challenge among more sensitive mothers, but a low, nonsignificant correlation among less sensitive mothers. Although Sethre-Hofstad et al. (2002) did not compare the correlations formally, the difference between them is substantial (0.47 and 0.09, respectively). Van Bakel and Riksen-Walraven (2008) replicated these findings in another community sample of mothers and their 15-month-old toddlers exposed to fear stimuli. The investigators found a significant, positive correlation of mother–infant cortisol slopes among dyads with sensitive mothers, and a nonsignificant, negative correlation among dyads with less sensitive mothers. Furthermore, maternal cortisol change from pre- to post-challenge was significantly related to displays of infant distress/uncertainty among sensitive mothers but not among less sensitive mothers ($r = 0.29$ and 0.03, respectively). Assessing a low-risk community sample across two challenges at infant ages 16 (frustration task) and 17 months (maternal separation procedure) in the context of maternal sensitivity, Atkinson et al. (2013) found strong dyadic cortisol attunement across both intercept and slope. Attunement was manifested in both more and less sensitive dyads, but the slopes were significantly more highly correlated among dyads with more sensitive mothers (*rho* = 0.42, 0.69). Hibel et al. (2015) assessed dyadic cortisol attunement in a sample with low income, assessed in early and late infancy, and in toddlerhood, in the context of barrier, mask, and arm restraint challenges. They found significant attunement slopes at all ages, with attunement consistently high at baseline, diminishing at post-challenge, and remaining stable thereafter; at all timepoints, however, attunement remained significant. Furthermore, maternal positive behaviors moderated the attunement decrease from baseline to post-challenge, such that attunement was stable in dyads featuring more positive mothers but deteriorated across time in dyads with lower positive maternal behavior. Hendrix et al. (2018) assessed a sample of dyads wherein the mother had been treated for psychiatric illness (typically depressive disorders) during pregnancy. At age 6 months, infants were exposed to a brief arm restraint and noise burst while mothers were observed. Mother and infant cortisol levels correlated across all four time points. Greater maternal positive affect, but not depression, was associated with stronger attunement. The psychiatric aspects of these findings are further discussed below.

Saxbe et al. (2017) studied parent–child cortisol attunement in both mothers and fathers, using two samples of preschoolers, one typically developing, the other diagnosed with autism spectrum disorder. Mother–child attunement was stronger in dyads that showed less behavioral coordination and less sensitivity, and possibly less behavioral attunement. Father and children showed significant attunement, which was significantly stronger in dyads that showed less behavioral reciprocity, and wherein fathers showed less sensitivity. These findings contradict those reviewed above, and as such remain interpretively challenging. Although Saxbe et al. (2017) controlled for diagnosis, it is possible that their sample involved more extreme disruption of communication, as discussed in the next section.

The Saxbe et al. (2017) study remains the only one to have examined father–child cortisol attunement. However, assessing a low-risk sample and using a maternal divided attention task as stressor, Clauss et al. (2018) found a significant, positive association between mother's satisfaction with her partner and cortisol attunement between mothers and their 4- to 10-month-old infants. The Clauss et al. (2018) findings indicate indirect

effects of the father on mother–child cortisol attunement.

Overall, findings heavily support a positive association between positive parenting and mother–child attunement. This relation holds from preterm infancy to preschool, and across varied measures of positive parenting, infant challenges, and analytic strategies. By contrast, father findings are few, and underscore the need to assess direct and indirect associations of each partner as they relate to caregiver–child cortisol attunement.

Maternal Disrupted Communication, Child Disorganization, and Related Features Disrupted caregiver communication reflects extreme insensitivity: Disrupted communication "exceed[s] the tolerance limits for supporting an organized infant attachment strategy … lead[ing] to infant disorganization." It represents, "[t]he derailment of communication between parent and infant in attachment-eliciting contexts … [It is] fear-arousing in itself because the infant [has] little sense of influence over the caregiver at times of heightened fear or stress" (Lyons-Ruth et al., 1999, p. 69). Disrupted caregiving is associated with child maltreatment and with maternal history of maltreatment (Guyon-Harris et al., 2021; Khoury et al., 2022), and involves affective communication errors, role/boundary confusion, fearful/disoriented behavior, intrusiveness/negativity, and withdrawal (Lyons-Ruth et al., 1999). As mentioned, these features result in disorganized child-caregiver attachment, itself associated with child maltreatment (Toth & Manly, 2019), poor relational modulation of arousal (Lyons-Ruth, 2003), and high emotion reactivity (Forslund et al., 2020) on the part of the child. Several investigators studied cortisol attunement as it relates to features of disrupted communication and disorganization.

Crockett et al. (2013) showed a strong, positive relation between severity of maternal disrupted communication and *divergence* of mother and infant cortisol levels in the Still Face Procedure, as assessed in a sample of 4-month-olds and their mothers experiencing income-deprivation. Similarly, Hibel and Mercado (2019) showed a significant negative correlation between mothers' intrusiveness and cortisol attunement with their 5- to 8-month-olds. Ludmer Nofech-Mozes et al. (2020), assessing 16-month-olds in the Strange Situation, found that dyads with a toddler classified disorganized showed increasingly divergent cortisol levels over time; as maternal cortisol levels declined, infant levels increased. This was not the case for non-disorganized dyads. Furthermore, disorganized dyads showed significantly greater divergence between mother and infant cortisol values than did non-disorganized dyads. Finally, Khoury et al. (2021), assessing cortisol attunement in mothers and their four-month-old infants in the still-face procedure, showed that mothers with a history of greater maltreatment showed increasing divergence in cortisol levels over time, as compared to mothers with a lesser history. Furthermore, mothers with a greater maltreatment history were less influenced by their infants' cortisol secretion levels than were mothers with a less pronounced maltreatment history. Given that infants signal their physiological state behaviorally (Middlemiss et al., 2012), their lack of influence on maternal cortisol reactivity may reflect the child's failure to signal, perhaps related to a history unresponsive parenting, and/or the mothers' failure to perceive infant signals (Alink et al., 2019).

Several investigators examined child correlates of disrupted communication and disorganization, albeit in the context of typically functioning dyads. Hibel et al. (2015) found that toddlers who showed greater emotional reactivity manifested lower adrenocortical attunement with their mothers. Saxbe et al. (2017) made similar findings with respect to father–infant attunement, as moderated by infant self-regulation (although this moderation was not significant among mother–infant dyads).

Overall, there is converging evidence that disrupted maternal communication and disorganization are related to diverging cortisol trajectories, or misattunement, in mother–child dyads. Furthermore, child correlates of disrupted communication and disorganization, specifically poor

emotion- and self-regulation, even as assessed in low-risk samples, are inversely related to cortisol attunement.

Maternal Mental Health As mentioned in the context of positive parenting, Hendrix et al. (2018) studied a sample of mothers who had been treated for (largely depressive) psychiatric illness during pregnancy, and their infants. Maternal depressive symptoms, assessed during pregnancy and at 66 months infant age, did not predict mother–child cortisol attunement. As mentioned above, however, maternal positive affect was related to cortisol attunement among these dyads. These findings may reflect mothers' ability to provide emotionally responsive parenting despite depression. It is also possible that successful treatment reduced depressive symptomatology, which, in turn, improved parenting. In any event, it is important to note that the relation between depression and attunement is complex. Consistent with the notion that the course of depression is a crucial determinant of mother–child attunement, Laurent et al. (2011) followed a sample of mothers at risk for parenting problems from pregnancy to 18 months. They found that infants with mothers who reported increased depression postpartum, as compared to during pregnancy, showed greater adrenocortical attunement than other infants. Also consistent with the moderated effects of maternal depression, Khoury et al. (2016) demonstrated, in a low-risk, community sample, that toddlers secreted more cortisol across each of two challenges (frustration and maternal separation) if their mothers endorsed more depressive symptoms *and* showed higher cortisol levels, as compared to other infants. The impact of maternal mental health on cortisol attunement appears complicated, and in need of broader examination, but it is not necessarily disruptive.

Correlation Without Attunement? As demonstrated, positive parenting is positively associated with cortisol attunement. Disrupted parenting and infant disorganization are negatively associated with attunement, and correlated child regulation features show a weakened, but still negative association with attunement. In seeming paradox, mothers and infants facing more extreme adversity may show significant, positive adrenocortical attunement. Thus, Hibel et al. (2009) showed that mother–infant dyads exposed to intimate partner violence (IPV) *involving physical or threatened physical aggression*, evinced more strongly correlated cortisol intercepts and trajectories in response to a fear/frustration lab challenge than did dyads from nonviolent homes. One explanation offered is that "two individuals in the same situation [i.e., mother and infant] … may simply exhibit similar physiological responses" (p. 621). This explication may be particularly apt here as "the unpredictable nature and high intensity of conflict in homes characterized by IPV [results] in a state of constant and heightened readiness to respond to ever-present threat and challenge" (p. 617). Laurent et al. (2011) showed that dyads with a mother who was not depressed prenatally but became more so postnatally exhibited closer mother–infant cortisol attunement than other dyads in response to a maternal separation procedure. Laurent et al. (2011) postulated that the cortisol associations reflect the dyad's attempt "to cope with the new demands of a high stress environment" (p. 535). One interpretation of both these findings is that the infant is attuned to mother's stress, and therefore exhibits extreme reactivity. Another possibility is that under extreme, shared stress conditions, caregiver and child react *independently but analogously* to the same environmental threat.

The possibility of independent but analogous cortisol reactivity is demonstrated by Hibel and Mercado (2019). They randomly assigned mother-father dyads from a low-risk community sample to positive and conflictual discussion conditions. Maternal cortisol was sampled during this episode. Infant (5 to 8 months old) cortisol was sampled during a fear and frustration paradigm. The investigators found significant reactive and recovery mother–infant cortisol attunement for the conflict group but not the positive discussion group. Recall that in the former group, mothers and infants were challenged

independently, but in the latter that group, infants were challenged, and mothers were not. These findings demonstrate that covariation does not necessarily reflect attunement. This may hold particularly in high-risk familial conditions, where parents and children may react independently to individually perceived threats.

It should be noted, however, that more recent IPV research contradicts earlier findings. Bernard et al. (2017) found that dyads who experienced higher IPV were less (not more) attuned than those who experienced lower IPV. However, Bernard et al. (2017) assessed IPV both pre- and postnatally and averaged the values. Therefore, some values may represent dyads who experienced IPV at one time or another, such that mothers and infants did not experience the same stressors in the same way at the same time or even in close proximity. Furthermore, Bernard et al. (2017) did not restrict their sample to physical aggression, or threats thereof (c.f., Hibel et al., 2011), the most violent and observable forms of abuse. Nevertheless, Bernard et al. (2017) findings signal the need for caution in accepting interpretations described above, and the necessity of further research.

Summarizing the cortisol attunement findings, it appears that positive parenting is positively associated with mother–child attunement, extremely negative parenting is inversely related to attunement (misattunement), and very challenging environments are positively related to degree of attunement. Interestingly, this nonlinear relation accords well with adaptive calibration model predictions (Del Giudice et al., 2011) as they pertain to individual responsivity across stress systems. Little research has been conducted on father–child cortisol attunement, although fathers appear to exert at least indirect effects on mother–child attunement (via mother's relationship satisfaction, verbal conflict, and IPV).

The findings reviewed above also hint at the complexities of covariation. Under what circumstances is it influenced by the parent? When is it driven by the infant? How does it operate as a transactional process? And when does it reflect a response to environmental influences that impinge on both infant and caregiver simultaneously but independently? This is not to say that these processes are mutually exclusive. A given interaction may integrate all these permutations simultaneously and/or in quick succession, depending on dyadic history and current conditions. Despite the intricacies involved, or because of them, these dynamics are crucial to fuller comprehension of stress physiology in infancy and beyond. A more complete conception of stress physiology across the lifespan likely depends on early biological attunement and its mediating, moderating, and contextual psychosocial antecedents, consequences, and correlates.

Coordination

Little research exists on the coordination of the HPA axis with other stress systems in early life. Beyond practical issues, including (nonintrusive) assay, factors more pertinent to allostatic considerations may account for this. First, the homeostasis concept, historically dominant, emphasizes localized reactivity, the response of isolated organs and tissues (Sterling, 2012; Sterling & Eyer, 1988) and has, by extension, been applied to more complex systems. Thus, the HPA axis, in its broadest terms a simple homeostatic system consisting of feedback loops, is easily isolated for the purpose of study. To oversimplify (see Gjerstad et al., 2018; Sheng et al., 2021 for fuller description), the hypothalamus releases corticotrophin-releasing hormone (CRH) in response to challenge, causing the pituitary gland to release adrenocorticotropic hormone (ACTH), which, in turn, causes the adrenal cortex to excrete corticosteroids. On abeyance of the stressor, in a negative feedback loop, cortisol binds to glucocorticoid receptors in the hypothalamus and pituitary gland to inhibit CRH and ACTH production, thereby facilitating cortisol downregulation and restoration of resting state; the HPA axis is "self-stabilizing" (Peters et al., 2017). Of course, other "higher level brain mechanisms" are involved in HPA reactivity, "to evaluate needs and set priorities" (Sterling, 2012, p. 2), as noted in the context of allostasis, and

cortisol itself stimulates physiological and metabolic changes in numerous downstream processes (Gjerstad et al., 2018; Lenart-Bugla et al., 2022; Sheng et al., 2021). However, these other processes are dispensable to the study of HPA axis function in its narrow sense, easily conceptualized as a "local, 'negative feedback' mechanism" consonant with homeostatic, but not allostatic, modeling (Sterling & Eyer, 1988, p. 631).

Another feature that renders the HPA axis an attractive target of isolated study is its end-product, cortisol, an active agent in and of itself; by contrast, many other hormones, enzymes, and neurotransmitters measured in the context of stress are surrogate markers. For example, salivary alpha-amylase (sAA) and plasma noradrenaline concentrations are *substitutes* for clinically meaningful endpoints, specifically, stress-induced sympathetic activation (Petrakova et al., 2015). However, "While there are studies investigating the relationship between individual markers (i.e., cortisol, cytokines, and C-reactive protein) and brain outcomes and stress …, the collective measurements seem to provide a better understanding of the complex brain processes" (Lenart-Bugla et al., 2022). Studying HPA function in isolation is a "potentially crucial limitation" (Laurent et al., 2011, p. 522).

Here, we emphasize the need to address HPA function as it coordinates with other systems because psychobiological integration is a defining feature of the allostasis construct (Ganzel et al., 2010; Peters et al., 2017; Schulkin & Sterling, 2019; Sterling, 2012; Sterling & Eyer, 1988). Allostasis involves the brain's agentic coordination of numerous systems that are activated and suppressed to facilitate the realization of a common goal (Sterling, 2012). To the extent that the individual is healthy, the brain titrates allostatic processes to the stressor at hand (flexibility, as described above). This much is emphasized with the terms "allostatic orchestration" (the brain organizes cross-system operations that undergird behavior at the organismic level) and "allostatic state" ("the integrated totality of brain-body interactions"; Lee (2019). This integration importantly differentiates allostasis from homeostasis: The latter involves self-regulation of organs and tissues individually; allostasis overrides homeostatic processes where necessary in the service of coordination (Sterling & Eyer, 1988).

The "high-level brain mechanisms" (Sterling, 2012, p. 2) that serve "executive and command functions" in allostatic processes involve emotional circuitry, including the amygdala, extended amygdala, hippocampus, and areas of the prefrontal cortex (Ganzel et al., 2010). The amygdala, for example, has reciprocal connections spanning stress systems from perceptual organs and cortical structures to the brainstem. In addition to these supraordinate connections, components of the stress system are directly linked to one another. For example, adrenocortical and sympathetic-adreno-medullary (SAM) systems act across different timelines (Granger et al., 2006, 2007) and circuitry, but adaptive response necessitates their harmonization via connections at multiple neural levels (Engert et al., 2011; Granger et al., 2006). Despite these considerations, very little research has been conducted on the coordination of the HPA axis with other stress systems in early life. For this reason, although the focus of this chapter is early human stress reactivity in the context of acute challenge, we augment coverage with reference to research on baseline cortisol, response to chronic stressors, and adult and nonhuman samples, where such research is instructive.

The work of Reindl et al. (2022) is informative both in terms of its judicious rationale for the selection of specific, stress-related analytes, and in terms of study findings. They collected single biological samples at three time points across a one-year period (an acknowledged limitation of the study). Participants (aged 3–7 years) were foster children and controls living with their biological parents. The following analytes were sampled: cortisol and dehydroepiandrosterone (DHEA), both HPA axis products but mutually antagonistic, perhaps representing net glucocorticoid function; progesterone, a hormone prerequisite to cortisol biosynthesis and important to the allostasis model, insofar as it promotes social engagement. Furthermore, given the link between

HPA axis activity and immune function, Reindl et al. (2022) also assayed secretory immunoglobin A (sIgA), previously found to be positively related to professional caregiver sensitivity in early daycare (Vermeer et al., 2012). This selection of systems and analytes, all associated with one another and with quality of social environment, and studied in the context of a sample with marked early social adversity plus controls, instantiates the reasoning behind simultaneous study of multiple stress systems.

Illustrating the power of this coordinated assessment, foster children had lower cortisol/DHEA ratios than did controls and higher progesterone levels (all integral to HPA axis function), but no significant group differences in cortisol, DHEA, and sIgA, as measured individually. Furthermore, children in foster homes with lower quality care showed lower cortisol/DHEA ratios than did their peers with higher quality care, and they showed decreasing sIgA levels across the 12 months of study participation. Across these indices, the explicit measure of coordination, the cortisol/DHEA ratio, was the only index to consistently emerge as significant, indicating greater sensitivity to early stress than any single indicator.

Regarding brief challenge studies, Davis and Granger (2009) assessed the coordination of HPA and SNS (sympathetic nervous system; measured via sAA) function in response to well-baby/inoculation procedures conducted at 2, 6, 12, or 24 months. Infant cortisol and sAA responses were positively correlated, but only at 6 months. Davis and Granger (2009) suggested that the effect was age-limited because this was the only age at which challenge effectively provoked both sAA and cortisol reactivity. Relevant to the lack of significant 24-month findings, Jansen et al. (2010) speculated that with age, the child's behavioral coping repertoire expands, reducing the strength of some physical stressors. Interestingly, Davis and Granger (2009) queried the existence of maternal sensitivity as an unmeasured but potentially moderating factor in the context of mother–infant adrenocortical attunement (see above), but not in the context of coordination. However, an early study showed that cortisol levels and vagal tone (a measure of parasympathetic function) correlated significantly when six-month-olds were engaged in a maternal engagement-disengagement paradigm, but not under nonstress conditions (Feldman et al., 2010). These results suggest potential social moderation of systems coordination under stress conditions.

Positive Parenting As described in the context of attunement, Hibel et al. (2018) assessed a sample of mothers and their 6-month-old infants. Mothers were randomly assigned to a high-conflict or neutral discussion condition with their partners. Infants underwent a frightening/frustrating challenge. Cortisol and sAA were sampled from each dyad member in their respective challenge. Maternal sensitivity was not correlated with infant cortisol-sAA coordination intercept, but it was positively associated with coordination slope, despite the fact that mother and infant had undergone different (age-appropriate) challenges. Hibel et al. (2018) concluded, "the sAA – cortisol connection is under social control, with stress response system coordination occurring only in supportive social relationships" (p. 48).

Of course, challenge selection is crucial in assessing cross-system coordination. Just as some lab challenges are better than others at precipitating cortisol responsivity (discussed above), so too are others better at precipitating alternate aspects of the stress response. For example, challenges involving mental or physical effort may promote sympathetic reactivity and cortisol reactivity only to a lesser extent (Lundberg & Frankenhaeuser, 1980; Skoluda et al., 2015; Ursin et al., 1978). Sampling mother-toddler dyads from a high-risk population, Laurent et al. (2012) showed that toddlers initiated a stronger SNS reaction to emotional challenges (clean-up task, emotion task battery) than to maternal separation, while the latter provoked more robust adrenocortical responsivity. Laurent et al. (2012) did not find cortisol-sAA coordination for mothers or toddlers within either of the two challenges, but they did find correspondence between

mother and toddler coordination across challenges. As maternal cortisol/sAA ratio increased, so too did that of toddlers.

In the context of a study discussed above (Atkinson et al., 2013), Jamieson et al. (2016) assessed physiological coordination across two challenges, one involving anger/frustration and hypothesized to elicit SNS, but lesser HPA reactivity, the other involving maternal separation and hypothesized to elicit HPA, but lesser SNS reactivity. As it transpired, mean toddler sAA trajectory was greater during the separation than the frustration procedure, indicating the need for further study of systems and contexts. More importantly, however, maternal sensitivity moderated the association between toddler sAA and cortisol basal activity and reactivity, such that systems were significantly coordinated at higher, but not lower, levels of maternal sensitivity. Quality of early caregiving appears to be important for the development of coordinated stress physiology, although data are scarce.

Parental Mental Health Laurent et al. (2011) assessed cortisol-sAA coordination in a community sample as dyads responded to a separation stressor. Infant systems coordination was partially explained by maternal depressive symptoms, such that a shift from lower depression during pregnancy to higher postnatal (5 and 18 months) depression predicted poorer infant cortisol-sAA coordination at 18 months. So, infants whose mothers became more depressed postnatally showed both greater cortisol attunement (see above) and poorer biological coordination; dyads were "more divergent across systems within a partner, but more unified across partners" (Laurent et al., 2011, p. 535). To resolve this seeming paradox, Laurent et al. (2011) proposed, "the differentiation between HPA and SNS profiles, with one appearing to compensate for the other across an acute stress episode, could be a testament to high allostatic load" (pp. 535–536). Clearly, more work is needed to unravel relations between parental (father and mother) mental health and infant systems coordination.

Early Adversity As shown in an adult sample, coordination of stress systems deteriorates with frequent psychosocial stress (Schommer et al., 2003). Retrospective adult studies show that poor quality of early care (Ali & Pruessner, 2012) and maltreatment (Gordis et al., 2008) are linked to poorer stress system coordination. Moreover, among adults, the sAA/cortisol ratio is more strongly associated with the quality of early care than either analyte alone (Ali & Pruessner, 2012; Engert et al., 2011). Of course, these studies involve adult samples, are typically retrospective in nature, and do not necessarily involve adversity in the earliest years of development. Nevertheless, a prospective study of rhesus macaques showed that juveniles that experienced maternal maltreatment in infancy showed weaker cortisol/sAA symmetry after a stressful episode than did nonmaltreated macaques. Moreover, the main effect of maltreatment status was not significantly associated with either cortisol or sAA levels alone (Petrullo et al., 2016), again indicating the power of integrated assessment.

Martinez-Torteya et al. (2017) assessed a primarily low-income sample of mother–infant dyads (mean infant age = 11.8 months). They found an association between prenatal IPV and mother-reported infant internalizing behaviors, particularly where infants reacted with cortisol/sAA asymmetry (specifically, high cortisol-low sAA) to an arm restraint challenge. Higher levels of externalizing behavior, on the other hand, were significantly associated with in utero IPV but not to cortisol/sAA ratio. Martinez-Torteya et al. (2017) concluded that, "assessing multiple stress biomarkers contributes to a more comprehensive understanding of individual vulnerability to adversity" (p. 40). Among older children, poor cortisol/sAA coordination interacts with harsh discipline, marital discord, and child depression to predict internalizing and externalizing behavior (Chen et al., 2015; Khoury et al., 2020; Koss et al., 2013), although these findings may depend on child age and sex, laboratory challenge, and behavioral informant.

In a multi-cohort study (children aged 4–14), Quas et al. (2014) extracted six coordination patterns between the HPA axis and the autonomic nervous system (parasympathetic nervous system measured via respiratory sinus arrhythmia and SNS measured via preejection period), all associated with early family adversity. Children with greater adversity (e.g., lower family income, parental conflict) were disproportionately represented in the 'multisystem reactive' group, compared to other reactivity types (e.g., moderate reactivity, HPA-specific reactivity). Of note, the "underaroused" pattern was not included in their analysis because of insufficient sample size, but other research suggests it is also associated with greater adversity.

Overall, the coordination of HPA activity with other stress systems remains grossly underresearched. Positive early experience appears to coordinate systems, and uncoordinated systems appear to predict negative behavioral outcomes, but findings are dependent on a host of moderators that require further study.

Flexibility, Attunement, and Coordination as Integrated Phenomena

We reviewed each of flexibility, attunement, and coordination separately. However, these processes are likely interdependent, all aspects of the broader allostasis dynamic. Thus, children of more sensitive mothers show greater adrenocortical flexibility *and* greater attunement (Atkinson et al., 2013) than children of less sensitive mothers. Children of mothers with fewer depressive symptoms experience greater flexibility (Ludmer et al., 2015) *and* greater coordination of stress systems (Laurent et al., 2012) than children of mothers with more depressive symptoms. On the other hand, infants whose mothers showed increased depression from pregnancy to postnatal evinced showed both greater attunement and poorer coordination (Laurent et al., 2011).

One might expect triadic interrelations, however, such that early environmental conditions influence cortisol attunement, flexibility, and coordination, and each influences the others in an integrated fashion. For example, one might suppose that the most advantageous combination *in the context of a positive environment* involves high flexibility, attunement, and coordination. In a more challenging environment, however, these relations may not confer advantage. High adrenocortical flexibility under risky conditions may leave the individual unprepared for frequent, unpredictable challenge via premature downregulation of adrenocortical activity, with attendant diminution of fight or flight readiness. (Incidentally, such speculation suggests that threat and unpredictability may be orthogonal constructs, requiring different challenges for their study and influencing stress system functions differentially.) High HPA attunement with a caregiver in disequilibrium may also be maladaptive, particularly if caregivers are unable to protect the child (e.g., IPV), experience lack of stress systems coordination themselves (increase in depression between pregnancy and postpartum), or are stress-inducing in their own right (disrupted communication, disorganized attachment relationship). Under such circumstances, immediate, independent, and instinctive reactivity may better serve the child than attunement with caregiver. Likewise, high cross-system coordination may be disadvantageous in a threatening environment. For example, under chronic threat conditions, continuous SNS activation may assure alertness, vigilance, and appraisal (via activation of the sympathetic adrenomedular system (Godoy et al., 2018), so as to precipitate HPA activation only under the most dire circumstances. Conversely, loss of adrenocortical flexibility may magnify the need for SNS activation as a recourse when HPA function has been debilitated by chronic use (allostatic load). The point is that use of the allostasis construct in its broadest conceptualization may provide new insights into early (and later) HPA function and its implications.

This much is instantiated by the attunement data, already sufficient to detect patterns that are not obvious when assessing child cortisol reactivity alone. The relation between positive parenting and higher attunement is consistent among term babies and in later infancy and toddlerhood. This

may not occur among infants born prematurely, but simple contact interventions increase convergence between these infants and their mothers. At high levels of positive parenting, attunement is high and significant. Correlations remain at more modest levels of parenting quality, although whether they are detectable depends on the quality of parenting (remembering that this variable is dimensional) and sample size (Atkinson et al., 2016). When parenting is hostile or frightening, as in of disrupted communication and disorganized mother–child relations, dyads are misattuned; associations between mother and infant cortisol secretion are negative, or diverge across time. Under more extreme circumstances still, as in IPV or with increased maternal depression pre- to postnatally, dyads manifest high positive cortisol covariation. This may reflect the intensity of maternal stress, and/or correlated but independent responsivity to the same environmental conditions. Data on flexibility and coordination remain underdeveloped, and across all dimensions, more work on father–child attunement, and the indirect influence of each parent on the other's parent–child attunement is needed. In addition, it is important that we study the ramifications of flexibility, attunement, and coordination on subsequent development. In this regard, for example, our best leads come from the coordination literature, which show positive, moderated links between poor coordination and internalizing and externalizing behaviors. Overall, though, a consistent picture is emerging that serves as a foundation for much-needed future research.

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Parent-Infant Adaptive Biobehavioral Intersubjectivity

13

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"Mirroring" implies that the mother is helping to create something within the infant that was only dimly or partially there until her reflection acted somehow to solidify its existence.

(Daniel N. Stern, "The Interpersonal World of the Infant" 1985, page 144)

Factors that Influence the Parental Brain

Parent-infant biobehavioral intersubjectivity, including recognition and acknowledgment of salient signals, interpersonal synchrony and reflective self-awareness, and emotion regulation toward social attachment are central to human survival (Ainsworth & Bell, 1970; Swain et al., 2004). Despite having evolved a highly adaptive maternal brain to regulate these functions, brain plasticity reveals vulnerability to stressors. Central to understanding parental strengths and weaknesses is the development of testable models of parental brain. Using neuroimaging methods and building on allied animal research (Numan & Young, 2016), the human neurocircuitry that governs parental behavior has been established over the last two decades with several evolving influences, models, and terminology (Barrett and Fleming, 2011; Feldman, 2017; Swain, 2011; Swain & Ho, 2017; Swain et al., 2007, 2014b). In this review, we mainly focused on the maternal brain but discussed the paternal brain when the evidence was available. We used gender terms including "mothers", "maternal", "fathers", and "paternal" because the existing literature uses those terms and most of the studies did not ask the participants how they identify themselves. However, we acknowledge that not all the birthing parents identify as mothers and the non-birthing parents identify as fathers.

In Fig. 13.1, we update a simplified maternal behavior neurocircuit (MBN) (Swain et al., 2019) comprised of two reciprocally inhibiting subsystems like those found to regulate motor control. Here we propose one subsystem for: **(1) maternal care**, mediated by the medial preoptic

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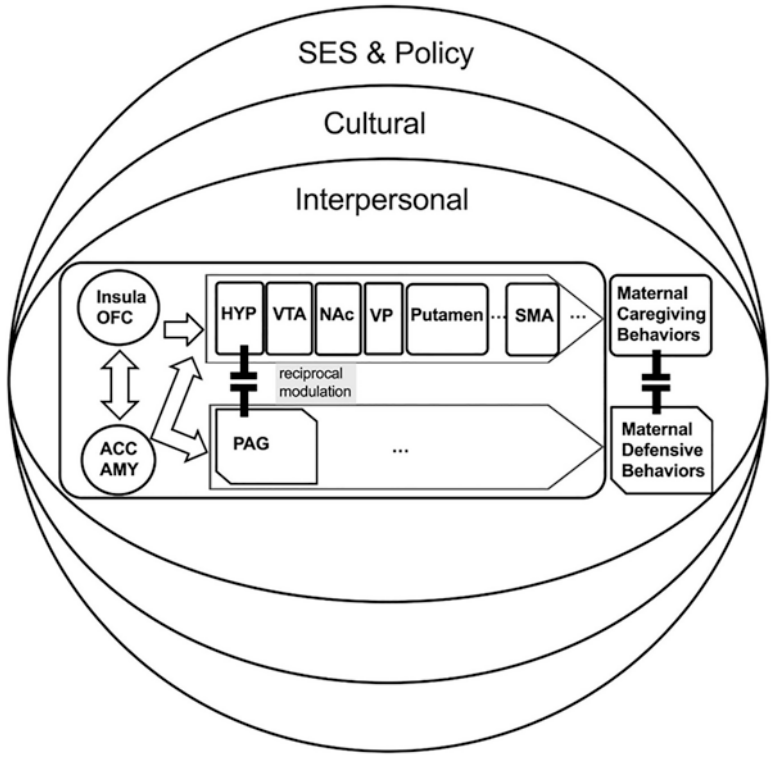

Fig. 13.1 The maternal behavior neurocircuit (MBN) in the contexts of interpersonal, cultural, and socio-economic status and social policy spheres. MBN is comprised of two reciprocally inhibiting subsystems for: (1) maternal care, mediated by the medial preoptic area (mPOA) of hypothalamus (HYP), ventral tegmental area (VTA), nucleus accumbens (NAc) and ventral pallidum (VP), which is functionally connected to the putamen and supplementary motor area (SMA), and (2) maternal defense, mediated by periaqueductal gray (PAG). These adaptively balancing subsystems are regulated by opioid-sensitive circuits that include the amygdala (AMY), BNST, insula, orbitofrontal cortex (OFC), and anterior cingulate cortex (ACC). This empirically supported model generates testable hypotheses for a better understanding of interpersonal contexts and interventions to promote family health

area (mPOA) of hypothalamus (HYP), ventral tegmental area (VTA), nucleus accumbens (NAc) and ventral pallidum (VP), which is functionally connected to putamen and supplementary motor area (SMA); and another for **(2) maternal defense/aggression**, mediated primarily by the periaqueductal gray (PAG). Many of these MBN subcircuits are also regulated by opioid-sensitive brain regions including amygdala (AMY), HYP, insula, orbitofrontal cortex (OFC) and Anterior Cingulate Cortex (ACC) and receive input from frontal regions to regulate maternal healthy intersubjectivity and compassion, the effects of stress and the benefits of therapeutic interventions as discussed below (section on Brain Mechanisms for Parenting Interventions, Intersubjectivity, and Compassion) (Ho et al., 2020).

Side Bar: Abbreviations

ACC	Anterior Cingulate Cortex
AMY	Amygdala
fMRI	functional Magnetic Resonance Imaging
HYP	Hypothalamus
NAcc	Nucleus Accumbens
OFC	Orbitofrontal Cortex
OT	Oxytocin
PAG	Periaqueductal Gray
PFC	Prefrontal Cortex
PTSD	Post Traumatic Stress Disorder
SMA	Supplementary Motor Cortex
STG	Superior Temporal Gyrus
VP	Ventral Pallidum
VTA	Ventral Tegmental Area

Maternal caregiving sensitivity governed by the MBN is related to a range of neuroendocrine systems early in the postpartum, including oxytocin (OT) (Feldman & Bakermans-Kranenburg, 2017) and cortisol (Swain et al., 2011). High-sensitivity mothers and lowest-sensitivity mothers were recruited according to mother–infant play interactions at 4–6 months postpartum for neuroendocrine studies (Elmadih et al., 2016). Participants' plasma OT measured immediately following their free-play interactions with their infant indicated that high-sensitivity mothers vs. low-sensitivity mothers showed significantly greater brain activation in the right superior temporal gyrus (STG) for own vs. unknown neutral infant and own-happy vs. own-neutral at 7–9 months postpartum. Furthermore, the right STG activation in this contrast was negatively correlated with post-free-play OT responses in high-sensitivity mothers, with the right STG in low-sensitivity mothers not differentially activated in response to own infant stimuli. In another study, dispositional personal distress was associated with greater cortisol reactivity to social evaluation for mothers, with ventral ACC response to positive versus negative child feedback to their parenting decisions inversely related to parenting-related cortisol reactivity (Ho et al., 2014). We have also established that OFC is more sensitive to own infant's cry in mothers grouped according to hormone-related processes of vaginal vs. cesarean delivery (Swain et al., 2008) and breastfeeding vs. non-breastfeeding (Kim et al., 2011). Thus, it is likely that individual differences in neuroendocrine responses affect dyadic interactions.

Relationships between individual and specific brain responses to baby stimuli and parental thoughts/actions for mothers and fathers in the neonatal period are beginning to be linked with the child's social and emotional development at toddler age. In one study (Kim et al., 2015), mothers and fathers were scanned while they listened to their own and unfamiliar baby's cry in the first month postpartum. Mothers' levels of anxious thoughts/actions about parenting in the first month postpartum (not at 3–4 months postpartum), were associated with lower child socioemotional competencies at 18–24 months postpartum. Maternal neural responses in motor cortex and substantia nigra were also positively and negatively associated with their anxious thoughts and actions, respectively. Among fathers, a higher positive perception of being a parent during the first month postpartum (not at 3–4 months postpartum) was associated with a higher toddler socioemotional competency. Paternal neural responses in auditory cortex and caudate were also positively associated with their positive thoughts, perhaps because of enhanced sensory information processing.

Indeed, exploring the similarities and differences among mothers and fathers is another important research frontier (Feldman et al., 2019; Swain et al., 2014a). In contrast to mothers, for which gray matter volume (GMV) increases over the first few postpartum months in several brain regions that support parental motivation, including the hypothalamus, amygdala, striatum, and lateral prefrontal cortex (Kim et al., 2010), father brains' GMV decreases in the orbitofrontal cortex, posterior cingulate cortex, and insula (Kim et al., 2014) suggesting sexually divergent adaptations. On the other hand, amygdala responses and connectivity for both mothers and fathers significantly overlap (Abraham et al., 2014).

Stress, Socioeconomic Status, and Parenting

Socioeconomic status, defined as economic and social position in relation to others, is a significant source of stress for families and as such has been associated with parent and child developmental outcomes across many domains. Socioeconomic status has been operationalized in the literature in multiple different ways but typically includes measures of income and/or education level. In this section, we review research on the associations between poverty and socioeconomic status on parenting and child outcomes, including both parent and child brain structure and response.

Socioeconomic Status and Parenting Economic hardship has long been associated with many different stressors for families and poorer outcomes for both parents and children. Family stress models, arising from Glen Elder's studies of the Great Depression's impact on families (Elder et al., 1985) and further elaborated by Rand Conger and colleagues' research with farming communities experiencing economic downturns (Conger & Conger, 2002) have been key theoretical frameworks guiding research on the relationship among poverty, socioeconomic status, and family outcomes. These models, which posit that economic disadvantage leads to economic pressure, which increases parental psychological distress, which in turn influences child outcomes through disrupted parenting and conflict between parents, continue to be supported by research over time with many different populations (for reviews, see Barnett, 2008; Masarik & Conger, 2017). The connection between economic strain and parental psychological distress is especially relevant to parenting, given that parental depression, anxiety, and distress are associated with impaired parenting behaviors. For instance, a meta-analysis of maternal depression (discussed above as impacting maternal brain function) has been associated with higher levels of disengaged and negative behavior as well as lower levels of positive behavior, with greater effects for socioeconomically disadvantaged participants (Lovejoy et al., 2000). Therefore, not only is poverty widely associated with increased risk for psychological distress, including depression and anxiety (Ridley et al., 2020), the effects of psychological distress upon parenting may also be greater for those parents who are also experiencing environmental pressures associated with income and socioeconomic status (Lovejoy et al., 2000). Related issues around parental psychopathology and culture will be discussed in the following section.

Research on the various effects of poverty and poverty reduction efforts, can specifically illuminate how these factors specifically impact the health of parents and parenting behaviors. For instance, following the expansion of the Earned Income Tax Credits in 1993, mothers with two or more children (thus receiving more benefits) reported improvements in mental and physical health and they exhibited reduced illness-related inflammatory biomarkers (Evans & Garthwaite, 2014). Similarly, another study found that an increase in cash benefits for families with children in Canada was associated with improvements in family outcomes over 6 years (Milligan & Stabile, 2009). Benefits included improved maternal health and child measures of development with reduced physical aggression and anxiety. Increases in family income have also been found to influence parenting behaviors. For example, increases in payments to families from casino disbursements have been associated with improvements in parent-reported supervision of their adolescents as well as adolescent reported increases in positive interactions with parents (Akee et al., 2010). Therefore, not only does poverty influence parenting and parental health, reductions in poverty in the form of additional income have been found to impact parenting behaviors and significant child outcomes. These findings strongly support policies that reduce poverty, as elaborated below.

The lack of resources available to parents in poverty is associated with their inability to spend money on enriching activities for their children outside of home and school, which may be related to academic achievement (Coley et al., 2020). Socioeconomic status is also associated with the amount of time that parents are able to spend with their children, with higher parental education associated with more time spent with children (Kalil et al., 2012). Therefore, socioeconomic status can influence the resources that parents have available for their children by limiting their ability to both afford experiences and material goods for their children and influence time spent together.

Conditions of scarcity, such as those associated with living in poverty, are also associated with disruptions to cognitive processes (Shah et al., 2018) and economic decision-making (for review, see (Gennetian & Shafir, 2015)). These alterations to cognitive processes may also influence parenting-related decisions and behaviors. For instance, recent research has found that

caregivers prompted to reflect upon financial scarcity speak less with their 3-year-old children in a play session (Ellwood-Lowe et al., 2022), and that child-directed speech is lowest at the end of the month, the time when Americans report the greatest financial strain (Ellwood-Lowe et al., 2022; Roby & Scott, 2022). For parents experiencing chronic conditions of financial and material scarcity, such as those associated with poverty, the salience of financial strain may be one factor contributing to disruptions in parenting behaviors, such as child-directed speech, which may ultimately impact children's development.

Socioeconomic Status and the Parental Brain Response Emerging research also suggests that poverty is associated with changes in parental brain response and the association between poverty and parenting may be in part mediated by parental brain responses to infants (Kim, 2021). During the postpartum period, the brains of parents undergo dynamic changes in their structure and function (Kim, 2016; Kim et al., 2016b). The changes include structural growth and increased brain activation in response to infant cues in brain regions that support parenting. These brain regions include the medial and lateral prefrontal cortex, insula, and superior temporal gyrus. These brain regions are involved in social and emotional information processing and regulation of negative emotions. Studies suggest that increased activations in response to infant cues such as infant crying sounds and infant faces have been associated with more sensitive parenting behaviors. However, among mothers, low income was associated with reduced brain responses to infant cry sounds in the medial and lateral prefrontal cortex and superior temporal gyrus (Kim et al., 2016a). Furthermore, the greater number of stressors that the birthing parents were experiencing including financial stress, substandard housing quality, and violence in the neighborhood was associated with reduced brain responses to infant cues in the insula and superior temporal gyrus (Kim et al., 2020). The reduced brain responses to infant cry sounds in these brain regions were further related to less sensitive parenting behaviors observed during the parents' interactions with her own infant interactions. Low income was also associated with reduced brain activation in the middle frontal gyrus during effortful emotion regulation, which was further associated with less sensitive parenting behaviors during interactions with own infant (Capistrano et al., 2022). These findings suggest that low income and exposure to severe stress may negatively influence brain sensitivity to infant cues and neural regulation of negative emotions. These differences in brain activation may further increase difficulties with responding sensitively to an infant sensitively during interactions and with developing deep emotional bonds with own infant among mothers.

Socioeconomic Status and Infant Outcomes Socioeconomic status has also been widely linked with infant developmental outcomes, starting at birth. Lower parental education, parental income, and neighborhood income, as well as parental occupations with greater risk, stress, and physical strain, have all been associated with increased risks for preterm birth, low birth weight, and infants deemed small for gestational age (for review see (Campbell & Seabrook, 2016)). In the United States, both lower familial income and increased income inequality have been associated with preterm birth, low birth weight, and infant mortality (Olson et al., 2010). Socioeconomic status has also been found to interact with other factors, such as maternal race, in its prediction of infant birth outcomes (Kothari et al., 2016) and may moderate the relationship between extremely low birth weight and cognitive and language outcomes at age 3 years (Kilbride et al., 2004).

Socioeconomic status has also been associated with cognitive and language outcomes in early life. Early language skills in particular have been associated with socioeconomic status defined in a variety of ways, including familial income, familial income-to-needs ratio, parental education, and type of medical insurance. Studies have found relationships between socioeconomic status and infant language abilities at

15–30 months (Wild et al., 2013), 18 months (Fernald et al., 2013), and 7 months (Betancourt et al., 2015). Socioeconomic status has also been associated with altered trajectories in the development of cognitive flexibility in infancy (Clearfield & Niman, 2012), differences in attention in infancy (Clearfield & Jedd, 2013), differences in selective exploration (Tacke et al., 2015), and differences in IQ scores at age 2 years (von Stumm & Plomin, 2015). In addition, socioeconomic status has been associated with measures of reading and math ability at kindergarten entry (Larson et al., 2015). These relationships between socioeconomic status and early infant cognitive and language functioning, as well as early academic performance, have important implications for children's later outcomes and success in both school and later life.

As noted earlier, poverty and socioeconomic status are associated with many household level stressors, including differences in the quality of children's home environments. Research has shown that poor families of 3-year-old children experienced more risk factors, which were then associated with less stimulating home environments (Brooks-Gunn et al., 1995). Poverty is also associated with more chaotic household environments, which is another factor associated with poorer child outcomes (for review, see Marsh et al. (2020)). In sum, the influence that socioeconomic status has upon household environments and the child's broader context (including family, school, and neighborhood contexts) may be one of the key mechanisms through which poverty influences child development, starting in infancy.

Socioeconomic Status and the Infant Brain Response Although there is still limited research looking at the effect of poverty on infant brain outcomes, there have been some findings suggesting the very early emergence of neural differences associated with familial income and socioeconomic status. Socioeconomic status (defined as a composite score of maternal education and income-to-needs ratio) has been associated with structural changes such as smaller cortical gray and deep gray matter volumes in 4-week-old infants (Betancourt et al., 2016). In another study, infants and toddlers (ranging from 5 months to 4 years in age) from families with low familial income (defined as family incomes below 200% of the federal poverty line) had lower total gray matter volumes, in addition to lower frontal and parietal gray matter volumes compared to children from high-income families (Hanson et al., 2013). Familial income was also related to trajectories of brain growth during infancy and early childhood, with children from families with low familial income showing reduced growth in total gray matter as well as in frontal and parietal gray matter (Hanson et al., 2013). Prenatal socioeconomic status, measured by parental occupation and income, has also been associated with neonatal brain morphology, specifically lower prenatal socioeconomic status was associated with greater local volumes in right occipital lobe, left temporal lobe, left inferior frontal and anterior central regions (Spann et al., 2020). While existing research is mixed in the directionality of the findings, with some studies suggesting reduced volumes and others indicating greater volumes, broadly there is evidence that poverty is associated with infant brain structure.

Socioeconomic status has also been associated with differences in functional brain activity in infancy. For instance, one study found that socioeconomic status (defined by insurance status, neighborhood level deprivation, and composite social risk measures) was associated with differences in striatum to prefrontal cortex resting state functional connectivity in newborn infants and that this connectivity mediated the relationship between socioeconomic status and behavioral inhibition and externalizing symptoms at age 2 years (Ramphal et al., 2020). Socioeconomic status defined by familial income and maternal education has also been associated with differences in sensorimotor and default mode network resting state functional connectivity at 6 months of age (Gao et al., 2014). Previous EEG research has also shown that parental occupation and income was related to lower power of

high frequency gamma-band oscillations over frontal regions in infants watching videos of toys and faces (Tomalski et al., 2013).

In discussing the impact of socioeconomic status on infant brain outcomes, it is important to note how exposure to poverty differs from other forms of early life adversity such as abuse and neglect. A recent large meta-analysis of youth ranging in age from birth to 18 years (Vannucci et al., 2023), found differing effects of interpersonal early adversity (which included caregiving disruptions, caregiver psychopathology, maltreatment, and interpersonal trauma) and socioeconomic disadvantage (which included family socioeconomic status, non-interpersonal trauma, community crime/violence exposure, neighborhood poverty, and area deprivation). Results from this meta-analysis suggest that exposure to interpersonal early adversity is associated with larger volumes in frontolimbic regions (e.g., amygdala, hippocampus, ventral anterior cingulate cortex (vACC), ventromedial prefrontal cortex (vmPFC), and ventrolateral prefrontal cortex (vlPCF)) in early childhood and but smaller regions in adolescents. Meanwhile, socioeconomic disadvantage was associated with smaller volumes in temporal-limbic regions (e.g., amygdala, hippocampus, parahippocampus, and temporal gyri) in childhood with the strength of the association decreasing with age.

Finally, recent research has indicated that poverty reduction interventions may influence infant brain activity. In a randomized control trial of unconditional cash transfers to low-income mothers, infants in the high cash group (compared to low cash group) displayed greater EEG power in the high-frequency bands (Troller-Renfree et al., 2022). While more future research is needed to continue to explore the impact of poverty reduction on infant brain response, these findings provide promising evidence that poverty reduction interventions may positively influence children's development at a neural level.

Thus, socioeconomic status has broad and specific impacts on both parents and infants, including at a neural level. Continued research in these areas will be important to help shape targeted interventions and guide public policy to support families and children early in life, addressed below.

Neurobiology of Parental Psychopathology

Parental stress increases risks for a broad range of psychopathology, including mood and substance use disorders. Parental psychopathology disrupts brain systems for emotion processing and regulation (Phillips et al., 2003) which overlaps with the maternal brain (Pawluski et al., 2021), i.e., balance between care and defense/aggression (Fig. 13.1). Critical to dyadic interaction, mood disorders interfere with facial emotion processing, emotion regulation, and mentalization (Samame 2013), negatively biasing the interpretation of others' emotional expressions and reducing reward processing (Carvalho et al., 2014; Elliott et al., 2011). Having been reviewed elsewhere, the adverse effects of affective psychopathology on parental brain function are serious (Pawluski et al., 2021; Swain & Ho, 2017) – especially given the compelling notion of transgenerational risk to the infants (Lomanowska et al., 2017). The current state of the art unsurprisingly indicates that mothers with affective disorders exhibit attenuated brain responses to emotional infant stimuli, for example, decreased emotional and reward system responses (Ho & Swain, 2017), and reduced white matter integrity in fronto-subcortical circuits important for adaptive parenting (Silver et al., 2018). Intervention research for parents is discussed in the next section.

The neurobiology of substance use disorders (SUD) and the parental brain is rapidly growing despite the challenges of participant recruitment, adequate controls, and complex comorbidities. Addiction is another disorder of stress regulation, in which the positive reinforcement of drugs of abuse may overtake the positive reinforcement of human relationships. Substance use continues despite the toxic effects because it relieves negative affective states of craving and withdrawal that develop with dependence (Koob & Le Moal, 1997, 2001). Research on mothers affected by

substance use disorder (SUD) indicates that they may find infant cues to be less gratifying and more stressful (Rutherford et al., 2011), and they become less likely to be attentively responsive to and more likely to be harshly intrusive with their infants (Strathearn & Mayes, 2010). Indeed, brain regions affected by addiction and those important for parenting significantly overlap, including reward systems (e.g., PFC, VTA, NAc) and regions that have been associated with stress and depression (e.g., PVN, hippocampus, extended amygdala) (Lebow & Chen, 2016; Rutherford & Mayes, 2017, 2019; Strathearn et al., 2019; Swain et al., 2019; Swain et al., 2017). The extended amygdala, which includes connections between the amygdala and hypothalamus, is also central to parental behavior control. So far, few studies have examined the impact of substance abuse on the neural circuits underlying human parenting. In the first such study, polysubstance-using mothers, relative to non-substance-using mothers, showed a decreased response to *unknown* infant cues (faces, cries) in sensory processing, prefrontal, and limbic regions of the brain (including the amygdala and parahippocampus) (Landi et al., 2011). Perhaps due to the use of generic images of infants rather than personalized images of the mothers' own infants, no findings emerged in this study with respect to the mothers' hypothalamic-mesolimbic activations – though findings suggested that infant stimuli may be less salient for substance-using mothers, leading to impairments in developing healthy infant-caregiver attachment. Similarly, mothers in treatment for addiction showed less response to their own infant's happy expressions in regions implicated in reward processing and increased activation in response to both own happy and sad infant expressions in regions of emotional, motoric, and cognitive processes (Kim et al., 2017). More recently, mothers with vs. without SUD exhibited decreased response in the ventral striatum using own and other baby picture stimuli (Rutherford et al., 2020) – perhaps reflecting reduced reward/motivation responses to signal that normally elicit maternal care. Consistently, EEG studies report delayed neural response to infant faces for smoking vs. non-smoking mothers (Rutherford et al., 2017) as well as for polysubstance-using mothers vs. non-substance-using mothers (Lowell et al., 2020). Reduced reactions to infant stimuli in substance-using mothers support the hypothesized reduced salience of infant affective cues, consistent with a reward-stress dysregulation model, and are in accord with studies of observed dyadic interactions where mothers with substance use disorders are more passive and disengaged from care (Strathearn & Mayes, 2010; Rutherford et al., 2011). Perhaps there are common brain mechanisms across SUDs that affect parental function.

Recent work has specifically addressed Opioid Use Disorder (OUD) and parental neurobiology. As part of a broader epidemic, pregnant women have been seriously affected, with OUD incidence quadrupling from 1999 to 2014. (Haight et al., 2018; Krans & Patrick, 2016). Indeed, peripartum women with OUD are at high risk for many health problems and, in order to manage withdrawal, they may receive "gold standard" buprenorphine treatment (BT/OUD) (Krans et al., 2016; Nanda et al., 2015; Rosenthal et al., 2016; Zedler et al., 2016). Despite the concerning preclinical work that opioids interfere with parenting, preclinical research has indicated that opioids may disrupt maternal behavior via opioid-sensitive regions of the MBN, including the hypothalamus, ventral pallidum (VP), PAG, and ACC (Bridges & Grimm, 1982; Grimm & Bridges, 1983; Moura et al., 2010; Slamberova, 2012). Indeed, there are longstanding concerns that opioids may hijack both healthy parent-infant separation distress and reward circuits that are sensitive to opioids and also critical to mother-infant bonding (Swain et al., 2005). Also, potentially "high opioid tone" from the administration of opioids during childbirth may be of concern for the development of normal social behaviors and risk for autism spectrum disorder (Anugu et al., 2021), which is one of several developmental disorders that highlight impaired intersubjectivity (Trevarthen & Aitken, 2001).

In recent neuroimaging work, the effects of OUD and BT on parental behavior are under study (Swain & Ho, 2021a). In the first report,

BT/OUD mothers showed greater hypothalamic and PAG responses to Own vs. Other's Baby-Cry as compared to healthy mothers (Swain et al., 2019). Also, Own vs. Other's Baby-Cry responses in the hypothalamus for BT/OUD mothers were associated with greater parenting stress index (PSI) scores. Furthermore, since both differential functional connectivity during Own vs. Other's Baby-Cry and resting state functional connectivity between the hypothalamus and PAG were associated with PSI, it was suggested that the PAG might be driving the hypothalamus as a function of parenting stress related to OUD, according to our model in Fig. 13.1 (Swain & Ho, 2021a). Of additional concern is potential disruption of brain circuits required for BT/OUD mothers to empathically mirror their child's emotions in infant-oriented sensitive behaviors (Swain & Ho, 2021b). On the other hand, although the normally reciprocal functional connectivity of care vs. defensive/aggressive maternal brain circuits was disrupted in the early postpartum for BT/OUD mothers and associated with impairments in parental bonding, the effects dissipated by 4 months postpartum (Swain & Ho, 2019). This suggested possible treatment benefits and capacity for maternal adaptation bolstered by the apparent normalization of overlapping maternal brain and pain matrix connectivity over this period (Swain & Ho, 2023).

In allied work, beyond the basic but critical relief from withdrawal for both mother and fetus during pregnancy (McCarthy et al., 2017), opioid treatments have been shown to reduce maternal separation distress and some aspects of depression (Panksepp & Yovell, 2014; Yovell et al., 2016) that may include heightened symptoms of pain (Serafini et al., 2018). Taken together, opioid therapy for mothers with OUD may both drive neural systems involved in maternal caregiving that may be impaired due to an underlying problem, yet also pose a risk of dysregulating the normal balance between maternal caregiving and defense/aggression circuits – critical for parenting behaviors, (Swain & Ho, 2021a). Our model (Fig. 13.1), along with the parenting intervention research on intersubjectivity for stress and depression discussed below, suggests targets for other therapies to inform and augment maternal psychosocial health for mothers with OUD.

Brain Mechanisms for Parenting Interventions, Intersubjectivity, and Compassion

Numerous evidence-based interventions target postpartum mothers' mental well-being and parenting capacity simultaneously (Erickson et al., 2019). They attempt to mitigate risk by reducing maternal depression, anxiety, and trauma-related stress symptoms, enhancing coping strategies, and fostering parenting abilities and reflective capacity. Several of these postpartum interventions are homebased (e.g., Attachment and Biobehavioral Catch-Up), while others such as Mom Power seek to overcome engagement hesitancy with a warm, safe, and welcoming environment to promote learning and practice of positive parenting. MP specifically promotes maternal intersubjectivity, correcting distorted or disengaged parenting beliefs, improving parenting sensitivity, targeting emotion regulation to reduce stress and improve health (Rosenblum et al., 2018). Parental intersubjectivity can be defined as the awareness of self and child's inner states based on interactions with their child, i.e., a form of reasoning and comprehension of covert, latent states of another person through inferences from overt verbal or non-verbal actions and perceptions. Here, we discuss parental intersubjectivity through the lens of a generalizable dyadic active inference framework, which we have supported with neuroimaging (Ho et al., 2020; Ho et al., 2022; Ho et al., 2021, 2023) as key to understanding how parenting interventions work to improve sensitive care.

Each person is an active inference engine In this computational model, each person strives to adapt to the environment by minimizing surprises during person-environment interactions. In its simplest form, the person-environment interactions constitute interactions between external states (E) and the person, where the person consists of sensory states (S), active states (A), and

internal states (I). The sensory and active states of an active inference engine serve as an interface with the environments. The internal state does not directly interact with the environment, rather contains prior beliefs that are updated and optimized through an error-minimization process (Ho et al., 2022).

Two states of active inference engine Dyadic interactions are key to the development of an active inference engine for mother-infant interactions. Active inference engines can appear to function in two distinct states, namely a strongly coupled state or a weakly coupled state (Ho et al., 2022). When two persons' active inference engines are entangled in the strongly coupled state, the input to one person's sensory states is predominantly coming from the output from the other person's active states, and vice versa. When the surprise is minimized during this strongly coupled state, one person's internal states are approximating the other person's internal states—reaching a higher level of intersubjectivity (Ho et al., 2022). Higher levels of intersubjectivity enable two people to understand one another's internal states underlying their overt behaviors. Notably, due to the strong coupling, the dyad will consist of mirroring of one another's actions, thus a strongly coupled state is necessary for parent-child synchrony. Conversely, when an active inference engine is not strongly coupled with another engine, it will exist in a weakly coupled state. In the weakly coupled state, an active inference engine will perceive the world from a self-centered perspective, as if the observer were independent of the observed objects in a self-other dichotomy (Ho et al., 2022).

Active inference engines can be hijacked by invalid beliefs in dyadic processes If a person fails to maintain the strong coupling during dyadic interaction, the surprise, which is proportional to the stress perceived by an active inference engine (Peters et al., 2017), will become excessive and therefore harmful for the dyad (Ho et al., 2022). We proposed that when invalid beliefs hijack the active inference engine, it leads to the problems of under-coupling and over-mentalizing during dyadic interactions (Ho et al., 2022). We postulated that invalid beliefs are nothing but invalid conceptual thoughts (*vikalpas* in Sanskrit) that are enshrouded in our systems by the working of mental fabrication/proliferation (*prapañca* in Sanskrit) (Ho et al., 2021). According to the work by Arya Asanga (circa 380 CE), a co-founder of Mahayana Buddhism, there are eight types of conceptual thoughts (*vikalpas* in Sanskrit) that obscure the realization of ultimate reality (Asanga, 2016).

Incorporating these ancient ideas, we postulated that invalid beliefs (*Vikalpas*) would impair the function of the active inference engine's internal states, node (I), preventing the engine from minimizing variational free energy (i.e., surprise). Holding on to an outdated, invalid (mis)belief to the extent of becoming pathological is equivalent to keeping an overweighted prior in one's active inference engine (Carhart-Harris & Friston, 2019). If the person fails to update or replace an outdated, invalid belief, it may result in excessive variational free energy and hence excessive stress (Goekoop & de Kleijn, 2021; Peters et al., 2017).

Three major problems that impair parental intersubjectivity according to the dyadic active inference model.

Of specific relevance to parenting, we proposed a dyadic active inference model to explain the inverse relationship between parenting stress and maternal intersubjectivity and identified key brain regions that may mediate this relationship using a pre- and post-test design with the evidence-based "Mom Power" parenting psychotherapy intervention (Ho et al., 2020). We identified three inter-related relational issues that are addressed by interventions that reduce stress in dyadic interactions. These are the problems of (1) *deficient relational benevolence due to invalid beliefs,* (2) *under-coupling, and* (3) *over-mentalizing,* as follows:

1. *Deficient relational benevolence:* Invalid beliefs prevent the awareness of relational benevolence. We have postulated that invalid beliefs (*Vikalpas*) will obscure the awareness of interdependence, and hence may diminish the awareness of relational benevolence and of the prior beliefs of each person's active inference engine (Ho et al., 2021). The deficiency results from overly compressing a two-dimensional space of parent-by-child interactions to one dimension of parent vs. child contrast, causing a parent to mis-believe that the child can only be either agreeable, disagreeable, or neither in reference to the parent, rather than seeing the dyad traversing a two-dimensional space, wherein their dyadic interactions can be mapped in a 2-by-2 matrix (i.e., parent's ["win" or "lose"] by child's ["win" or "lose"]) and thus there are four possible outcomes of their dyadic interactions, i.e., win-win, win-lose, lose-win, or lose-lose, instead of three standard outcomes, i.e., agreeable, neutral, or disagreeable.
2. *Problem of under-coupling:* Under-coupling increases surprise. When the parent's sensory and active states engage the child's active state only, the parent will ignore the child's internal state and sensory state. For example, the parent neglects to see that his or her harsh reaction upsets the child's feelings and only focuses on how to change the child's behaviors. Due to such under-coupling, the parent may see the child as an object without its own feelings and prior beliefs, and thus the parent would fail to achieve intersubjectivity and find it difficult to reduce stress in the dyad.
3. Problem of over-mentalizing: Over-mentalizing can perpetuate invalid belief and exacerbate dyadic stress. When there is a disagreement or conflict between two persons, dyadic stress may increase if person 1 becomes defensive against person 2, as if person 2 were an enemy, and therefore misattributing person 2 disagrees behaviors to malice or character flaw, i.e., over-mentalizing. For example, the parent may over-mentalize the child's behaviors as "he does not respect me". When mother's over-mentalizing explains away child's actual prior belief, she will not even recognize her own ignorance of child's feelings and prior beliefs. When stress potentiates mother's over-mentalizing, child's disagreeing behaviors would only confirm mother's preconceived existing biases against child, perpetuating the impairment of intersubjectivity in a vicious cycle.

In a neuroimaging study, we studied mothers before and after Mom Power, a parenting intervention, using a Child Face Mirroring Task (CFMT), designed to elicit maternal intersubjectivity-dependent responses to their own vs. unknown children while either imitating or simply observing (Ho et al., 2020). The within-subject changes in parenting stress were positively associated with concurrent changes in the differential responses during prediction error-related (positive vs. negative valence) contrast in the imitating (mirroring) own child's faces vs. its control condition in the PAG, a subcortical region related to fight-or-flight aggressive/defensive motivation. Conversely, responses were negatively associated with those in the amygdala and NAc, two subcortical regions related to social reward motivation. From the first (pre-intervention) scan to the second (post-intervention) scan, the within-subject changes in parenting stress were positively associated with the functional connectivity between the dorsomedial prefrontal cortex (dmPFC) and PAG, and, conversely, negatively associated with concurrent changes in the functional connectivity between dmPFC and NAc, during the imitating (mirroring) own child's faces vs. its control condition. Connectivity with the dmPFC may be interpreted in relation to at least two functions: (1) social mirroring behaviors and (2) representing the significant other (Ho & Nakamura, 2017). The parenting intervention effects on stress reduction were partially mediated by differential changes in subcortical functional connectivity in maternal brain regions of NAc and PAG. Notably, brain regions underlying surprise or deviation from expectation largely overlap with these subcortical

motivational neurocircuits, including the amygdala, nucleus accumbens (NAc), and PAG (Swain & Ho, 2017).

In support of the central importance of intersubjectivity in dyadic interventions to reduce parenting stress, a theory-guided analysis of 35 intervention studies reported efficacy to reduce parenting stress by promoting relational benevolence and training skills that mitigate potential under-coupling and over-mentalizing problems in parents (Ho et al., 2022). This report suggests to add over-mentalizing to the consistent work of others (Provenzi et al., 2018) on indicators of quality parental sensitivity in parent-child interactions, including mutuality, reciprocity, attunement, contingency, bidirectional coordination, matching, mirroring, reparation and synchrony. To dig deeper into this issue, we now discuss compassion as meditative intervention to mitigate the problem of over-mentalizing (Ho et al., 2021, 2023).

According to Buddhist definitions, compassion (*karuṇā* in Sanskrit) refers to the wish that others be free from suffering, and benevolence (*maitrī* in Sanskrit) refers to the wish that others be happy (Buswell & Lopez, 2013). Compassion is a seed for great compassion (*mahākaruṇā* in Sanskrit), which is defined as the wish to free *all sentient beings* from suffering. Great Compassion is distinguished from compassion by its scope and its personal agency (Buswell & Lopez, 2013). Compassion meditation is a graded process of ever-broadening identification, i.e., treating someone as if they are oneself without discrimination. A practitioner begins with the identification of identity with those near and dear to oneself, such as within a parent-infant dyad. Progressively, the practitioner can extend the scope of identification to friends who share interests, then to strangers who may not share interests, to ("strangers"), then to enemies who are in conflict, and eventually to all sentient beings. With this in mind, the practitioner maintains a commitment to attaining self and other's aims through his or her own work of compassion and benevolence.

In parent-child interactions, parent-infant compassion and benevolence is the seed of future compassion and eventual enlightenment. The development of compassion and wisdom depends on the capacity for strong dyadic coupling. Thus, compassion meditation may contribute to therapies by mitigating the problems of deficient relational benevolence, under-coupling, and over-mentalizing (Ho et al., 2021, 2023). The identified three problem domains should serve as the viable salient focal targets of any effective intervention to be further developed and evaluated for ameliorating stress experienced by parents.

Parent-Child Synchrony Across Culture

The longstanding issues found at the intersection of parenting, child mental health, and culture are differences vs. universals of childcare and child development in our species and the contributions of culture to parenting, child mental health, and parent-child relationships. Perhaps lessons may be learned from the study of different societies that may offer partial answers to how parents organize the effective environments of childhood in ways that may offer potential policy recommendations.

Parenting, which requires time and effort – especially during infancy when children are entirely dependent on their parents – varies across cultures (Lansford, 2022) in terms of cognition and practices (Bornstein & Esposito, 2020). Parental responsibilities for childcare are a function of the situation and underlying implicit beliefs – often ingrained in diverse cultural cognitions and behaviors across social groups (Bornstein, 2013). Thus, it is possible to document how culture affects families (both parents and children) through differential parent–child interactions informed by cultural beliefs and practices around the world. The concept of culture is pertinent to the constantly changing dynamics of individuals in their social context (Kuwabara & Smith, 2021). Being raised as a member of a particular culture, as a function of the ecological setting, influences how parents interact with and raise their children to meet the

desired cultural expectations (Bornstein & Esposito, 2020; Rosenthal & Roer-Strier, 2001). Parenting practices often take on similar vs. different forms across cultural boundaries based on their surrounding conditions and function even with culturally different beliefs.

On one hand, different parenting practices may emerge through intersections of cultural cognition and behavior within social and geographic surroundings (Bornstein & Esposito, 2020; Lansford, 2022) with growing evidence for parental cognition and behavioral similarity or even universality (Rohner & Lansford, 2017). For example, mothers are likely to spend more time with their children as compared to fathers around the world (Bornstein, 2015; Lansford et al., 2016; Pastorelli et al., 2021). Based on this premise, however, the research in the area of parenting practices has focused on mothers' over fathers' interaction with children (Feldman, 2007), leaving gaps that have begun to be gradually filled (Feldman et al., 2019). The following sections discuss parent-child interactions across cultures, including variations and overlap, leading to a selective review of the neuroplasticity underlying these adaptive behaviors and potential for this intersection of science and culture to inform policy and parent-child health.

Differences between Parenting across Cultures Cultures change with time and are influenced by factors such as globalization, technology, social media, urbanization, etc., that have an assimilating effect on some aspects of culture, especially cultural practices. Therefore, it is crucial to acknowledge cultural differences in parenting. Parents in different cultures often possess pre-determined beliefs to approach parenting tasks, and value parenting outcomes. They also differ in their opinions about the significance of specific competencies for their children's successful adjustment, the ages they expect children to reach different milestones or acquire various competencies, and so forth (Lansford, 2022).

The idea of cultural uniqueness illustrates how different cultures differ in form and function. Studies from many cultural backgrounds offer a variety of perspectives on parenting beliefs and behaviors. For example, despite having child-centered modern civilizations, the United States and Japan have different parenting values. American women tend to encourage their early childhood to be independent, aggressive, verbally skilled, and self-actualizing. Japanese moms, on the other hand, exhibit emotional maturity, self-control, social grace, and interdependence (Bornstein & Esposito, 2020). In another study, systematic differences across countries such as Belgian and Argentine mothers' child-rearing practices were attributed to their cultures (Gottlieb & DeLoache, 2016). For example, Argentine mothers display inflated self-esteem despite rating themselves low and blaming themselves for low parenting competence and satisfaction. Such insecurities were also congruent with a lack of social support for child-rearing. By contrast, Belgian mothers reported higher satisfaction with their caregiving due to support from Belgium's strong childcare support provided to parents (Bornstein & Esposito, 2020). The belief systems and variety of child-rearing practices across cultures were also examined in ethnographic studies within the context of cultural scripts (Greenfield, 1994). While European American women transmit cultural values through mother-child communication, family interactions are crucial to Taiwanese parenting. Parents also utilize a variety of communicative styles across cultures, for instance, mothers speak differently when conversing with young children. They may employ several strategies to address the prelinguistic communication barrier, and how they provide care is influenced by the social ecology in which the newborns and parents reside (Lansford, 2022). For another example of cultural differences in parenting, compared to mothers from the former Soviet Union, Israeli mothers place a higher value on leadership, individuality, and social skills. Conversely, mothers in the Soviet Union placed a comparatively higher value on success, efficiency, emotional control, and organization (Rosenthal & Roer-Strier, 2001). These studies of differences in parenting

highlight the perceptions and values of the respective cultures impacting parenting practices.

Similarities between child-parent across cultures Despite differences across cultures, several similar practices exist across cultures that are often termed universally adaptive (Bornstein, 2015; Lansford, 2022). Parents in every culture across the globe nurture and protect their children with a balance of warmth and expectation/discipline, supported by the maternal brain circuits for care and defense/aggression (Fig. 13.1). These similarities in every culture start from physical caregiving, such as feeding and protecting children from environmental contaminants, especially for mothers, are central to many cultures based on the amount of shared mother-child time. Parents universally help their kids through similar developmental tasks, such as attainment of physical health, social adjustment, academic success, and financial security, yet may use different cultural practices (Bornstein et al., 2015). Despite variable hierarchies of parenting value, another common cross-cultural feature is the caregiver responsiveness to children as a gateway to universally needed provision of love, warmth, and acceptance for children to survive and prosper (Bornstein, 2013). For example, in one study of mothers from both the Soviet Union and Israel, mothers aspired for their children to grow into intelligent, joyful, and independent adults, get a good education and hold prestigious occupations (Rosenthal & Roer-Strier, 2001).

Language is the primary communication medium between mother-child in many cultures after childbirth, with vocal exchanges forming the cornerstone of language learning and social engagement during the early developmental period (Bornstein et al., 2015). Children and infants depend on their parents' mental stimulations and emotional security during this time. This mental stimulation promotes language development and aids in secure attachments across cultures. For example, children have a universal need for love and acceptance that can be fulfilled by warm (as opposed to hostile, neglecting, or rejecting) relationships with parents (Rohner & Lansford, 2017). Thus, through language, cultures may inflect unique differences in parenting form and function with some universals and corresponding neurobiology.

Convergence of Neuroscience and Culture in Parental Caregiving Evolutionary biology, neuroscience, developmental science, and cross-cultural psychology are coming together to explain human caregiving behavior and supportive neurobiology across cultures. First, there is a complex interaction for responses to infant cues, among variables of parental status, sex and infant facial expression (Parsons et al., 2017). Although fathers and their co-parents play key roles with adaptive neuroendocrine systems (Abraham & Feldman, 2018, 2022), mothers have received more study, likely as they are usually primary in responding to their baby cues as emotionally important with rapid orienting responses, as demonstrated in high temporal resolution studies with EEG and MEG that highlight the importance of the OFC (Young et al., 2017). In a landmark study of mothers across 11 countries and 5 continents, mothers' behavioral responses to own baby cry differed in many ways, but also documented universal parenting behaviors of picking-up, holding and talking to their infants (Bornstein et al., 2017). Complementary fMRI neuroimaging of subgroups in the United States, China and Italy demonstrated similar patterns of brain response to own baby cry in the SMA, inferior frontal, STG, midbrain and striatum, all of which are consistent with brain circuits required for responsive movements and speech (Bornstein et al., 2017).

On the other hand, in the United States, there were differences in brain responses to infant cues between White birthing parents and Latina birthing parents (Aran et al., 2023). There were no differences in parenting behaviors observed during the parent and infant interactions between the two groups. However, white mothers exhibited greater brain activation to infant cry sounds in the insula, dorsolateral prefrontal, somatosensory, and premotor cortices compared to Latina moth-

ers. The lower brain activation to infant cry sounds among Latina birthing parents was associated with higher Mexican Orientation and a higher number of non-biological children living in the same household. Thus, parenting experience prior to the birth of the first child and acculturation may contribute to the different levels of brain responses to infant cues among mothers.

Father Involvement in Parent-Child Interactions Researchers have often minimized the role of father interactions in the long-term development of the child. Fatherhood roles have changed dramatically and transculturally since the late twentieth century as more mothers join the workforce full-time and fathers are more involved in childcare, precipitating considerable research progress. Like mothers' cognition and beliefs, every culture has scripts for fathers' nurturing practices based on their membership to the subgroup of a society. In one related study, North American vs. Vanuatu (a small-scale society), fathers slowed their fundamental frequency and range of speech when interacting with infants. In contrast, Vanuatu vs. North American fathers used a higher average pitch when speaking to infants (Broesch & Bryant, 2018). Perhaps there are systematic societal differences in how fathers communicate with infants, indicating different strategies to solve the prelinguistic communicative challenges according to different social ecologies.

In addition to purely communicative approaches, fathers are universally essential to children's social and academic outcomes, although there are some potentially interesting differences. Fathers in the United States are likely to take an equal part in caregiving tasks based on time availability during weekends and the number of children in the household (Lansford, 2022; Lansford et al., 2016)**.** With respect to (1) primary caregiving tasks and (2) engagement tasks, fathers from the United States, Taiwan, and Thailand were universally likely to spend more time on engagement tasks than caregiving tasks. However, fathers in the United States showed higher involvement in infant caregiving during the weekend when compared to fathers in Taiwan and Thailand. This observed difference may be due to higher social expectations for fathers in the United States to be the breadwinner during the week (Yeh et al., 2021). Other studies suggest opportunities for targeted interventions. For example, in a 15-week parenting intervention for risky parenting attitudes among fathers, African American fathers were inclined to assume more risky parenting attitudes than Hispanic and Puerto Rican young fathers (Mogro-Wilson et al., 2019). Further work is needed on the underlying causes of risky behaviors and culturally sensitive approaches to parenting – especially for fathers.

Policy Inferences for Parent-child Interactions The importance of cultural context in parent-child interactions is emphasized by foundational principles from developmental science, neuroscience, and cross-cultural psychology. Studies demonstrating the negative impacts of poverty and stress on both parents and infants (Ho et al., 2022; Yoshikawa et al., 2012) highlight the importance of income support such as family leave programs during pregnancy and the postpartum period (Bullinger, 2019). Exposure to trauma and stressful life events both in childhood and during the perinatal period increase risks for perinatal psychopathology and harsher parenting among parents (Choi & Sikkema, 2016). Therefore, policy to provide support parents who experienced trauma and/or are exposed to high levels of stress such as more integrated mental health support with prenatal care will be critical to the well-being of both parents and their infants (Nillni et al., 2018). Perhaps the single most important function of parenting is to enact the culture into which that child is born (Bornstein, 2013) through universal behaviors of picking-up, holding and talking to their infants. Thus, social policy might keep in mind the means to optimize these behaviors, without prejudice about all the differences. Further culturally sensitive research may support regional policies that support local practices.

Summary and Key Points

The parental neurobiology that governs parent-infant interactions that are critical to infant development provides a compelling and powerful theoretical and empirical framework for the fields of social and emotional development. The brain circuits that shape the parent-infant bond are central to potential transgenerational risks and potential resiliencies for the infants are fantastically adaptive yet also vulnerable to stress and psychopathology. Advances in neuroimaging techniques, experimental paradigms, and participant groups promise better models. Increasingly careful is being paid to the measures of parental thoughts, behaviors, and outcomes (Kim et al., 2013), as demonstrated in a recent study in which brain activity in response to own baby cry correlated with a measure of mental state talk, but not with more global aspects of observed caregiving (Hipwell et al., 2015). The child will likely be included in forms of neuroimaging that allow for more natural movement, such as with functional near-infrared spectroscopy (fNIRS) (Safyer et al., 2020). Electroencephalography (EEG) has shown that the Attachment and Biobehavioral Catch-up parent coaching intervention was associated with larger increases in event-related potential responses to emotional faces relative to neutral faces, which in turn was associated with observed maternal sensitivity (Bernard et al., 2015). In support of EEG to reveal treatment effects, a recent study showed the effects of CBT for mothers with PPD depression (Amani et al., 2023). Further, such work with simultaneous mother and infant brain measurements or "hyperscanning" (Schwartz et al., 2022) promises to inform the understanding of the parent-infant dyad. Neuroimaging practices are, however, still coming to terms with reproducibility problems of low statistical power and analytic approaches. Better-powered and longitudinal studies with more personalized and increasingly naturalistic approaches that may reflect real-time parental planning, responding and decision-making may overcome some of the neuroimaging problems of other fields. Finally, combining resting state and other connectomic (Sripada et al., 2014) and multimodal circuit-level approaches may be enhanced with the potential utility of machine learning methods to develop diagnostic and prognostic models for healthy parental adaptation vs. psychopathology (Orru et al., 2012).

Conceptualizations that parent-infant dyadic synchrony may be a specific instance of empathy and altruism with health benefits for all (Brown & Brown, 2015; Konrath et al., 2015; Swain et al., 2012) have led to recent parental brain studies before and after therapeutic interventions, which aim to promote maternal empathy, reflective functioning, and stress reduction skills (Muzik et al., 2015). In addition to the first such fMRI studies, discussed above using Mom Power intervention (Ho et al., 2020; Swain et al., 2017), another intervention, Attachment Biobehavioral Catch-up was studied for effects on the infant brain (Valadez et al., 2020) over a similar multimonth period. It is remarkable that both of these two studies, on mothers and children respectively, independently and with different parenting interventions and neuroimaging tasks, show cingulate activity changes. Perhaps universal circuits for cortical control, in addition to adaptative modification onto which different cultures inform parental behaviors will be fully detailed in the brain over the coming decades.

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The Paths of Intersubjectivity During Infancy

14

Massimo Ammaniti and Cristina Trentini

This chapter deals with the theme of intersubjectivity, which describes the continuous and reciprocal interactions and mutual understanding typical of human beings from the initial days of life, a process in which "humans come to know each other's mind" (Bruner, 1996, p. 12). In past decades, intersubjectivity has been of great interest in many scientific fields, from infant research to relational psychoanalysis and from social cognition to neurobiology, each taking its own research methods and theoretical models—and all nonetheless leading to unexpected convergences.

An Overview of Theories of Intersubjectivity

Considering the large amount of research data and clinical observations concerning intersubjectivity, it is difficult to establish an integrated conceptual framework that can account for the interactions between various complex systems that occur during infancy.

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The study of the multiple rich levels that characterize infants' social encounters with their caregivers should not neglect the complex interaction between the mind and the brain-body systems, which can shed new light on intersubjectivity and its development. Using a different language, Winnicott (1975) had already underlined that "It is not logical (…) to oppose the mental and the physical (…). Mental phenomena are complications of variable importance in psyche-soma continuity of being, in that which adds up to the individual's self" (p. 254).

In the area of infant research, intersubjectivity has been conceptualized differently by researchers and clinicians. Considering more specifically the infant's developing intersubjectivity, Trevarthen (1974, 1979) has suggested that the infant is born with a receptive competence to catch subjective states in other human beings. Infant survival and wellbeing, in fact, depend not only on a bond with the caregivers who guarantee his or her protection but also on the maintenance of an intimate exchange with them, which implies face-to-face interactions involving looking, touching, and vocalizing, along with real protoconversations that have a clear turn-taking structure. Further studies (Trevarthen, 1989) have confirmed that this inborn capacity of infants has an important role in stimulating the interest and affective sharing of parents, motivating their reciprocal relationship and companionship. The infant's communicative motivation and the

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correspondent intuitive parental attitudes represent a special human genetic predisposition for social learning, which has been defined by Trevarthen as *primary intersubjectivity*. In this interactional context, infants can elicit and sustain an interchange of affective expressions with parents, facilitating synchronized and mutual states of mind during social engagement (Trevarthen, 2009).

Stern (1985) has a different view: intersubjectivity is an "innate, primary system of motivation, essential for species survival, and has a status like sex or attachment" (Stern, 2004; p. 97), but this human predisposition emerges in the second semester of life. For this reason, it is not adequate to speak of primary intersubjectivity (as Trevarthen does) at 3–4 months of age, simply because infants of that age lack the necessary competence. According to Stern, intersubjective relatedness implies the capacity to share experiences with other people as they happen through joint attention, sharing intentions, and affective states of resonance. At approximately 9 months of age, infants alternate their gaze between an object and their mother's face and share intentions, communicating through gestures, postures, and vocalizations, with awareness of the effect on the caregiver. Finally, with affective attunement (Stern, 1985), infants look toward the caregiver to read his or her facial affective expressions to discover what they should feel. Stern embraces a more constructivist perspective on intersubjectivity that requires the achievement of the subjective felt security and attachment goals.

Another point of view is suggested by Hobson (2002), who refuses the idea that social understanding is turned on by biologically predetermined modules of the brain, arguing that it instead arises from the affective relationship between parents and infants during the first 18 months of life. In this regard, Hobson (2002) writes "the human infant is drawn into the mental life of her caregiver *through* her perception and responsiveness to the bodily expressed attitudes of the adult (…) by the end of the first year of life, the baby is focused on *the person* when she shows her things, points things out to her, and imitates her actions (…) identifying with people is what leads to mental perspective-taking" (p. 271).

Tomasello (1999) does not accept that early interactions could have an intersubjective meaning as suggested by Trevarthen, because infants need to reach 9 months of age before they can understand others as subjects of experience. Considering the developmental sequence of infant socio-cognitive abilities, Tomasello believes that only at around 9–12 months infants can engage in new behaviors that indicate a deep change in the way they understand the social world, specifically the intentions of other persons. In this context, sharing attention represents a unique human communicative behavior that emerges in infants in close synchrony, within a four-month window. These "skills of cultural cognition" (Tomasello et al., 2005, p. 676) are based on intentional action—namely, understanding and participating in activities involving shared intentionality, two skills that are interweaved during normal human ontogeny.

Although Tomasello has more recently also taken into consideration emotional relatedness besides intentional understanding, according to Hobson (2005), it remains unclear how the process of emotional sharing intervenes in the latter. As Hobson (2005) clarifies, emotional engagement not only plays an important role in sharing experiences but motivates involvement "with the bodily-expressed psychological states of others such that infants want to share, to communicate, to help, and to inform others" (p. 703).

In this review of theories of intersubjectivity, we should also consider the contribution of Meltzoff and Gopnick (1993), which was based on findings from research on neonatal imitation. They propose that infants understand that other persons are "like me" from birth, but it is difficult to clarify how that process works. This understanding—which is already present within the first few months of life—could represent a key element for the later acquisition of recognition that other people are intentional agents. In any case, these different theoretical perspectives share the conviction that the ninth month is critical for the infant's development of intersubjectivity.

An infant's development of intersubjective abilities is sustained by parents' capacity to be *sensitive*—that is, to detect, interpret, and respond appropriately to the emotional underpinnings of their infant's overt behavior. Parental sensitivity does not emerge when the infant is born; rather, it originates during pregnancy, when both women and men are confronted with dramatic psychological and neurobiological changes (Ammaniti & Gallese, 2014) that enable them to become parents and create the intersubjective matrix (Stern, 2004) within which the child's sense of security develops.

Motor Planning and Social Behaviors in Fetuses

Research on prenatal development has documented the emergence of an ability for motor planning and control that relies on primitive self- and (in the case of twin pregnancies) other-bodily awareness. According to Myowa-Yamakoshi and Takeshita (2006), by the 22nd week of gestation, single fetuses have "knowledge about intersensorimotor relations in their bodies" (p. 289), which is confirmed by their ability to anticipate the opening movement of their mouth before the arrival of their hand. Zoia et al. (2007) have also proven that by the same gestational stage, the spatial and temporal characteristics of single fetuses' movements are not casual. In this study, Zoia et al. found that peak velocity for the movement toward the eyes was earlier and lower than that observed for the movement toward the mouth. According to the authors, these results provide evidence for a precocious motor planning process in the fetus that is based upon the anticipation of the sensory consequences that a movement may generate on a target organ: "the fetus seems to "know" that the mouth is bigger and less delicate than the eye" (Zoia et al., 2007, p. 224).

These findings raise relevant questions. Firstly, how are the abilities for motor planning and control used when a fetus shares the space with another individual? Then, do these capabilities represent the more primitive bodily awareness that mediates social interactions with others? Twin pregnancies offer the unique opportunity to address these questions.

Inter-twin contact—which is observed from the tenth to 11th week (Sasaki et al., 2010)—inevitably becomes a persistent and increasing quality of twin pregnancies between the 15th and 22nd weeks (Piontelli et al., 1997). Castiello et al. (2010) investigated the kinematic profiles of movements made by five pairs of twin fetuses to test the hypothesis that intra-pair contact is the result of motor planning rather than an accidental outcome of spatial proximity. Using four-dimensional ultrasonography (4D US), the authors found that, by the 14th week of gestation, twin fetuses display not only movements directed toward the uterine wall and self-directed movements but also movements specifically aimed at the co-twin. Although the proportion of self-directed movements decreased between the 14th and 18th weeks of gestation and no difference in the proportion of movements directed toward the uterine wall was evident between those two gestational time points, the incidence of other-directed movements progressively increased to reach 29% of observed movements at 18 weeks. Notably, when aimed at the eye region (the most vulnerable part of the body), self- and other-directed movements presented similar kinematic profiles. According to the authors, given their fine differentiation and accuracy, these early contacts are not accidental: rather, they reflect the expression of a precocious motor planning ability—or (as we believe) of a *primary motor intentionality*—that prepares the fetuses to enter and actively act in the intersubjective world. Since this is a species level of development with respect to its "happening", specific prenatal infant experience of transactions affects individual differences in both structures and functions. By virtue of this, it may be assumed that some fetuses may be better organized at birth than others.

Overall, the results of these studies not only show the complexity (as well as developmental trajectories) of motor abilities, but also oblige the emergence of social behavior to be predated the fetal period. As shown in the work of Castiello et al., when the context allows (as in the case of

twin fetuses), other-directed actions are not only possible but also predominant over self-directed actions. It may be assumed that these findings provide evidence for the initial emergence of an *interpersonal self* before birth.

The Development of Intersubjective Abilities in Infants

Intersubjective Abilities During the First Semester of Life

At birth, the infant shows an integrated intermodal sensory-motor coordination whose antecedents rely (as we have reported above) on the prenatal period. These early abilities allow the infant to preferentially orient to human cues and to properly express social signals with the aim of engaging adults in interactive exchanges (Ammaniti & Gallese, 2014; Murray et al., 2016). The function of the infant's intermodal coordination is supported by brain maturational processes that occur after birth (see further in the chapter), as well as by intuitive responses of significant others (Murray et al., 2016; Trevarthen, 2001).

Trevarthen's original conceptualization of "innate intersubjectivity" aimed to describe the trajectory of the infant's inborn motive to relatedness, which is underpinned by early social abilities (Trevarthen, 1974, 1979). According to Trevarthen's theory, the first level of intersubjectivity (or *primary intersubjectivity*) implies the presence in infants of an early self-and-other awareness, which enables them "to possess an active and responsive conscious appreciation of the adult's communicative intentions" (Trevarthen & Aitken, 2001, p. 5).

The initial behavioral indicator of primary intersubjectivity is represented by the infant's ability to imitate facial movements performed by an adult (such as opening of the mouth or protrusion of the tongue or lips), as documented by Meltzoff and Moore (1977) in their laboratory study on six newborns (of whom one was only 60 min old). The peculiarity of early imitation lies in the fact that newborns use parts of their body of which they do not yet have any visual experience. The imitated movements provide the infants with proprioceptive feedback that enables them to match what they see in an adult's face with what they perceive during their own movements. As Meltzoff and Moore (1977) stated, the infant compares

> the sensory information from his own unseen motor behavior to a "supramodal" representation of the visually perceived gesture and construct[s] the match required (…). [Imitative behaviors] are not innately organized and 'released' but are accomplished through an active matching process and mediated by an abstract representational system (p. 78).

It should be remembered that Meltzoff and Moore's findings have generated many perplexities in some authors, who considered early action-observation matching as an automatic and involuntary reflex-like phenomenon rather than actual imitation. Such a reflex-like phenomenon was thought to be driven by subcortical mechanisms and based on an innate releasing mechanism, similar to that described by Lorenz and Tinbergen (1938). According to this view, what Meltzoff and Moore (1997) defined as "imitation" was instead considered a stimulus-conditioned matching that occurred only for fixed and stereotypic gestures released by the corresponding adult ones. As we know, research has largely disconfirmed such a view by providing robust evidence for the ability of infants to reproduce a wide range of (not merely stereotyped) gestures, as well as to correct their own movements to make them converge with those of the observed adult (Meltzoff & Moore, 1997). Moreover, studies on deferred imitation have proved that infants can reproduce gestures after a 24-hour delay, from at least 6 weeks of life (Meltzoff & Moore, 1994).

In more recent years, findings from the longitudinal study by Oostenbroek et al. (2016) have stimulated a new and heated debate on neonatal imitation. In their study, the authors showed that infants from 1 to 9 weeks of age did not imitate facial gestures such as tongue protrusion. These findings have been interpreted as undermining "the idea of an innate imitation module and [as suggesting] that earlier studies reporting neonatal

imitation were methodologically limited" (ibidem, p. 1334). Meltzoff et al. (2018) did not delay in rebutting Oostenbroek et al.'s claims. Firstly, Meltzoff et al. identified several flaws in the study design that had biased the results toward null effects, thus underestimating infants' early imitative competence. Secondly, after having obtained Oostenbroek et al.'s raw data, Meltzoff et al. executed new analyses and—contrary to Oostenbroek et al.'s conclusions—provided strong evidence for tongue-protrusion imitation at all four ages tested (that is, at 1, 3, 6, and 9 weeks after childbirth). Undoubtedly, as Meltzoff et al. (2018) have stated, the still-ongoing debate "about the origins and development of infant imitation may reflect its importance to theories of developmental science" (p. 7).

The following indicator of Trevarthen's primary intersubjectivity is the ability of 2-month-old infants to engage in temporally coherent and rhythmic-turn-taking vocalizations with both mothers (Trevarthen, 1993) and fathers (Kokkinaki, 2010). These interactions feature a sort of organized narrative (the *protoconversation*), which is characterized by a precise and synchronized timing in the way adults and infants address one another and reply: they wait for the expected vocalization from the other and then, after a pause, resume vocalization as if to elicit a new response (Bateson, 1979). The infants stimulate their parents to use a special affectionate, melodic, and questioning form of infant-directed speech—the so-called "motherese" (Fernald, 1992) and "fatherese" (Belsky & Volling, 1987)—which is accompanied by movements of head, eyebrows, eyes, and hands. The infants respond to this special way of speech, cooing and moving the head, as well as hands, lips, tongue, and body, just as if they were "conversating" with their parents. Even though they share several features, motherese and fatherese also show some specific differences. In fact, when speaking to infants, mothers exaggerate vowels more than fathers do (Gergely et al., 2017); moreover, the pitch qualities of motherese are more stable than those of fatherese, across infant development. It has also been shown that, by virtue of their preference for the higher range and warm modulations of the female voice, infants tend to pay more attention and respond more to motherese than to fatherese (Niwano & Sugai, 2003).

The evolution of infants' intersubjective competence is fully appreciable within face-to-face interactions occurring during the second semester of postnatal life. During interactions, emotionally available parents (Emde, 1980) respond to infants' interactive initiatives and, simultaneously, compensate for the still-immature regulatory strategies that infants use to attain a steady state following stress (Ammaniti & Trentini, 2009). These processes require the parents—particularly the mothers, at early stages of development—to be sensitive: that is, able to perceive, interpret, and respond appropriately to the emotional underpinnings of their infant's overt behavior.

As conceptualized in the mutual affect regulation model (Tronick & Weinberg, 1997), parent-infant interactions are characterized by movement from coordinated (or synchronous) to miscoordinated (or mismatched) states. During these mismatched interactive states, the infants propose several motor and expressive schemes (such as crying, protest, or funny faces) to re-establish a level of contingency with their parents (Ammaniti & Trentini, 2009). Sensitive parents are intuitively inclined to attune infants' affective states and to respond to their interactive initiatives. At the same time, the parents accept the momentary interactive disengagement of their infants and wait for them to be available again for relational exchange, without limiting the expression of their autonomy. From a developmental point of view, the transient absence of interactive reciprocity has a fundamental adaptive value for infants: it allows them to empower their own hetero-regulatory abilities, to feel competent within affective interactions, and to develop a trust in the emotional availability of their parents to act as external affect regulators for them. As Stern emphasized (1985), these intersubjective experiences not only positively affect the construction of the infant's Self but also influence the development of the sense of "we", a sort of connective net that ties the baby to parental figures, letting him feel part of the familiar world.

Intersubjective Abilities During the Second Semester of Life

At around 9 months of age, infants' relational motivation changes and moves from dyadic person-to-person interactions (primary intersubjectivity) to a person–person–object relationship (*secondary intersubjectivity*). As Bruner (1983) has highlighted, joint action routines emerge at this point and infants become more able to understand the intentions that guide the actions of other people, especially their parents, and are better predisposed to adjust their actions and cooperate with adults. This infantile sharing of others' attention has been further clarified by Meltzoff and Brooks (2007), who have observed that infants begin paying attention to mothers when the mothers are not looking at them and cast their gaze to external objects, like other children or spouses; consequently, the infant is motivated to check what the mother is looking at. This typical gaze that follows is an important index of secondary intersubjectivity. This behavior is not provoked by maternal bodily movement but rather by consideration of the mother's visual direction toward an external target. Infants are also attracted by the objects offered by their parents, explore them manipulatively (inspecting, shaking, poking, banging, throwing, etc.), and show the joy of sharing through their emotional facial expressions (e.g., of joy, surprise, or complicity).

A further developmental step is characterized by the emergence of joint attention, which implies triadic coordination with objects and persons "resulting in a referential triangle of child, adult, and the object or event to which they share attention" (Tomasello, 1999, p. 62). Three main joint attentional interactions progressively emerge: the first to appear (between 9 and 12 months) is joint engagement with an extended social interaction; the second (between 11 and 14 months) is social referencing to adults; and the third is imitative learning, acting on objects as adults do.

Constructivist Perspective on Intersubjectivity

Some of Trevarthen's assumptions about the primary forms of intersubjectivity have been largely questioned by Stern. Consistent with Trevarthen and Meltzoff, Stern also believed that intersubjectivity is an innate and emergent human capacity that relies upon the early awareness of the presence of other persons. Nevertheless, embracing a more constructivist perspective, he also supported (as we do) that "true" intersubjectivity occurs only from 9–12 months of age, which period constitutes a "quantum leap" (Stern, 1985, p. 124) in development.

A further key point of criticism raised by Stern concerns the role played by the affects. In contrast to Trevarthen and Meltzoff (who focused on behavioral correspondences), Stern considered *affective* not only interpersonal exchanges but also exchanges that involve objects and intentions. From this perspective, Stern (1985) conceived *affect attunement* as the most relevant manner of sharing subjective experiences (and thus as a particular kind of intersubjectivity). Affect attunement is described as the "automatic" (because not aware) ability to cross-modally match the timing, intensity, and "shape" of self and others' behaviors, which enables the infant both to capture the inner feeling states of others and to discriminate whether those states are currently shared. From this perspective, Stern coined the theoretical construct "vitality affects" to describe the feeling quality of *how* a behavior is performed.

In more recent years, research has provided confirmation of Stern's intuitions by evidencing the propensity of mothers to deploy specific forms of responses to infant social behaviors that typically embody the characteristics of "vitality affects" (Stern, 1985). In line with this, Murray et al. (2016) investigated the development of infant social expressiveness, considering two different accounts, namely: the contingency of parental responses (regardless of their form), and the "*preparedness* of both infants and parents to respond in specific ways to particular forms of

behaviour in their partner" (p. 1). The authors have found that during the first 9 weeks of age, infant expressiveness is already highly structured and reflected in the merging of different individual social behaviors (such as vocalizations, smiles, and pre-speech mouth movements). Notably, the authors also found that increasing infant expressiveness (which is particularly evident by the third week of age) is not related to the amount of maternal contingent responses (even to infant social expressions); rather, it is predicted by the *way* mothers respond to infants' social expressions (i.e., by mirroring or marking with a smile). These results provided evidence for a functional architecture of mother-infant interactions that relies on infants' readiness to benefit from specific and relatively infrequent forms of maternal responses. As Murray et al. (2016) have specified, "This is not to say that contingent associations are irrelevant (…) Rather [this is to affirm] that the *form* of parental response is critical, indicating the experience-expectant nature of the development process" (p. 7).

By virtue of its automatic nature, affect attunement belongs to the realm of implicit procedural processing and, as such, contributes to the development of the capacity for psychic intimacy and a sense of security. Implicit processing is non-symbolic, non-verbal, procedural, and unconscious. During the first year of life, this form of processing organizes and stores affective, cognitive, and bodily components of relational experiences (Ammaniti, 2018), to create an implicit relational knowing that continues to operate outside explicit appraisals and conscious experiences throughout life.

From Interactions to a Meeting of Minds

More recently, Bråten and Trevarthen (2007) have proposed a third form or layer of intersubjectivity that is known as *tertiary intersubjectivity*. Toward the end of the first year of life, an infant's world becomes extremely more complex. The infant not only interacts in a more coordinated and collaborative way with family figures but also becomes more able to perceive the motivations of others, especially their parents.

As linguistic competence develop, children acquire the ability of symbolic communication, through which they can communicate about actual or not-directly-present things or people These abilities favor the development of a second-order domain for mental simulation (or understanding) of another's mind and emotions (Bråten & Trevarthen, 2007), which opens the capacity for perspective-taking. Being able to assume another's perspective allows children to feel concerned for distressed (even fictional) others, to engage in self-other imaginative dialogs, and to complete others' aborted statements by virtue of other-centered participation. Advances in perspective-taking are supported by the emerging capacity to simultaneously consider self and others from a third-person view. By the end of the second year, these cognitive competence allow children to understand that their own intentions might not match those of others (Tomasello et al., 2005) and that others' emotions or thoughts can be influenced by factors that might not be directly dependent on current circumstances. Now, children do not only share minds but also understand minds (Barresi & Moore, 2008).

By virtue of its characteristics, joint attention has been considered a precursor of the representational theories of mind (Baron-Cohen, 1991; Meltzoff & Gopnick, 1993).

The Triadic Scenario in Toddlerhood

Research has evidenced that infants are engaged in triadic relationships from the first months of life. During toddlerhood, these relationships acquire greater complexity and ultimately intertwine with the construction of identity. However, this same period also involves other acquisitions connected to the construction of one's own "subjective self" (Stern, 1985), with a more complex self-organization which opens new domains of relationships. The acquisition of the subjective self implies that, in this period, infants begin to recognize not only their own sex/gender but also that of the people they meet, considering that, at

3–4 months, they distinguish female faces from the male ones. Recent studies have documented that, between 18 and 24 months, 50% of toddlers understand gender identity and show a knowledge of gender labels (Poulin-Dubois et al., 1998).

These studies fall within the socio-cognitive perspective, while the developmental scenario was described by Mahler et al. (1975) in a psychoanalytic perspective which privileges the psychic and relational dimensions of children between 15 and 24 months in the process of separation-individuation. The *practicing subphase*, in which infants begin to detach from parents and start exploring the world while also maintaining access to their caregivers as a source of comfort and safety, is followed by the *rapprochement subphase*, in which ambivalence of infants toward the primary caregiver emerges and—according to Lichtenberg et al. (1993)—is also expressed in relational behaviors.

During the rapprochement crisis, Mahler described normative responses as consisting of renewed separation distress accompanied by a new ambivalence toward comforting contact with the mother after separation. Gradually, the infant becomes more conscious of himself or herself "as a relatively helpless, small, and separate individual" (Mahler et al., 1975, p.78), pulled between a more advanced individuation and a separation anxiety. At the same time, the toddler possesses better verbal comprehension, which opens up the symbolic domain. This step is also confirmed by the recognition of himself or herself, which involves being able to think about himself or herself as an independent being that has a mind and thoughts that are separate and distinct from those of others. This is an important acquisition, as it marks the beginning of the theory of mind (ToM; Baron-Cohen, 1991), which is the ability that enables infants not only to understand the actions of social agents in terms of underlying mental states but also to distinguish between their own mental states and those of others.

From a different perspective, Bowlby (1969, 1973) and Sander (1962) described the exploratory behaviors of children, who, by crawling and walking, begin to detach from the primary caregiver while maintaining a secure relationship without ambivalence.

However, this rapprochement is a source of ambivalence—or rather ambitendency—not only for the male child but for the female child as well. In fact, the desire to return to the mother clashes with the fear of being engulfed by her and of returning to the dependence of the past. According to Benjamin (1995), even though children tend to disidentify from their mothers, they continue to remain partially identified with both parents. Moreover, Benjamin believes that children are able to recognize (even partially) the differences between their parents and introject these identifications as aspects of themselves. At this stage, the mother represents attachment, holding, and caretaking, while the father represents the outside world, exploration, and freedom. For a baby girl, returning to the mother is more reassuring because she is reflected in her, even with the danger of feeling drawn into a regressive relationship.

At this stage, children are hyper-inclusive and have multiple identifications; rather than being characterized by differentiation, identification is more about similarities and commonalities. Psychoanalytical conceptualization assumes that gender identity is still undefined and ambiguous at this stage and that differentiation will occur more fully in the following oedipal phase. It can be assumed that children are initially bisexual because they identify with both parents. According to Benjamin (1995), the recognition of sexual difference is not as linked to the discovery of sexual attributes, but rather to partial recognition of multiple cross-gender identifications with both mother and father in the rapprochement phase. In this phase, a triadic interaction is created, characterized by the intertwining between difference and commonality before reaching the oedipal phase, in which a part of the self must be sacrificed, even though secondary identifications remain. Here, the parents can help to process these ambivalences: if the mother welcomes the child's return without making him or her feel guilty about leaving, the child can escape the danger of recreating a fusion bond. In the event

that the mother, being too narcissistic or depressed, tries to recreate the fusion dynamic, the baby girl may relapse into dependence by renouncing the figure of the father.

On the developmental level, we may find a concordance if the child is helped by both parents to process multiple identifications without disidentifying from one or the other or to separate one of the two figures and so avoid a discrepancy that is intertwined with gender identity. In other words, the oedipal triangular dynamic is not the only one: triadic interactions characterized by ambiguities and discrepancies that affect gender identity also occur in this phase.

Neuroscience and Intersubjectivity

As we reported above, the functionality of the integrated intermodal sensory-motor coordination that a child is endowed with at birth is linked to transformations that occur in the infant's brain after birth. During the postnatal period, the brain undergoes highly programmed sequences of maturational changes, whose unfolding is strictly dependent on the quality of the infant relational experience. Structural magnetic resonance imaging (sMRI) studies have evidenced that the volume of the cerebral cortex increases prominently during the first year of life (when it reaches about the 70% of its adult size), and subsequent increases progressively become smaller beginning from the second year of life (Knickmeyer et al., 2008). Meanwhile, the time course of cortical synaptogenesis is heterochronous, with the cerebellum having the greatest increase in volume during the first year of life, followed by subcortical regions and finally by cortical areas (Knickmeyer et al., 2008). Between 3 and 4 months, rapid bursts of synaptic differentiation occur in both the visual cortex and in the prefrontal cortex. While in the former synaptic density peaks between 4 and 12 months, in the latter the increase in synaptic density is instead more gradual, and adult size is reached well after the first year.

In this section, we will illustrate how these brain transformations interact with the development of infant intersubjective abilities.

Brain Transformations and Infant Intersubjectivity During the First Semester of Postnatal Life

Positron emission tomography (PET) studies have documented that, even before 5 weeks of age, metabolic activity is highest in subcortical regions and the sensorimotor cortex (Chugani, 1994) (see Table 14.1, for a concise description of the neurobiological systems cited in this chapter). Recent electroencephalography (EEG) research has shown that shared representations between self and others are reflected by mirror mechanisms in an infant's sensorimotor cortex (Simpson et al., 2014), similar to the mechanisms found in adult brains (Gallese, 2006).

Mirror neurons are a distinct class of neurons that discharge when an individual either performs a goal-directed action or observes someone else performing the same action. Mirror neurons—and the nonconscious, prereflective, and presymbolic functional mechanism that they underpin (the *embodied simulation*; Gallese, 2003)—allow individuals who are confronting others' behaviors to experience a specific phenomenal state of "intentional attunement" (Gallese, 2006). This state generates a peculiar quality of familiarity with other individuals that is produced by the resonance of their emotions and intentions with the observer's simulation.

EEG studies on young infants have largely investigated the mu rhythm during action execution and action observation (Cuevas et al., 2014; Marshall & Meltzoff, 2011). The mu rhythm is generated over central sites most prominently in the resting state and is desynchronized (that is, attenuated or suppressed) prior to or during motor events. Mu rhythm desynchronization is considered a marker for mirror neuron activity because it is associated with the activation of cerebral areas recognized as having mirror properties, such as the inferior frontal gyrus, the ventral premotor cortex, and the posterior parietal lobe

Table 14.1 Neurobiological systems involved in infant intersubjectivity[a] and parenting[b]

	Cerebral areas	Functions
Infant intersubjectivity[a]	Sensorimotor cortex	Shared representations between self and others (*early imitative behaviors*)
	Right temporoparietal junction	Integration of visual, auditory, and tactile inputs (*protoconversations*); detection of socio-cognitive variables relevant to *ToM*
	Dorsal prefrontal cortex	Triadic (infant-other-object) representations (*joint attention*)
Parenting[b]	Hippocampus	Modulation of memory and learning
	Medial preoptic area of the hypothalamus	Initiation of parental behavior
	Insula	Translation of motor representations of infants' facial expressions into their emotional significance
	Superior temporal sulcus/gyrus, precuneus, posterior cingulate cortex, temporoparietal junction, ventromedial prefrontal cortex	Cortical mentalizing network
	Orbitofrontal cortex	Socio-emotional behaviors, emotion regulation processes, modulation of the affective propensity toward infants

(Arnstein et al., 2011; Simpson et al., 2014). In infants, observation of an experimenter who is performing a goal-directed action using a particular body part (hands or feet) is associated with desynchronization of the mu rhythm of the corresponding area of the body in the infant's sensorimotor cortex (Marshall & Meltzoff, 2014; Saby et al., 2013).

Such somatotopic patterns are considered an index of the "intercorporeal mapping of corresponding body parts between self and other" (Marshall et al., 2013, p. 22) that allows the infants to engage in early imitative exchanges (Meltzoff & Moore, 1977, 1997). These somatotopic patterns also provide neuroscience evidence of the "Like-Me" framework (Meltzoff, 2007, 2013), according to which infants parse a similarity (or an equivalence) between their own bodily acts and the bodily acts of others. We assume that these abilities rely on a primitive self-other bodily awareness whose origins date back to the prenatal period (Castiello et al., 2010; Myowa-Yamakoshi & Takeshita, 2006; Zoia et al., 2007).

But what happens in an infant's brain while they are being imitated?

Saby et al. (2012) have demonstrated that sensorimotor mu rhythm desynchronization is greater when infants observe an adult who matches (imitates) their actions compared to when they observe an adult who mismatches their actions. These findings are coherent with those of behavioral studies, in which infants have been found to look longer and smile more at an imitator than at an adult who performed a mismatching (even though contingent) response (Meltzoff, 2007). Consistent with this pattern, Meltzoff (2007) has concluded that infants "prefer the social partner who is behaving 'like me' lover the one who simply acts 'contemporaneous with me'" (p. 127).

While there is substantial evidence that mirror mechanisms are already available in the precocious stages of life, much less is known about the role played by the early social environment on their development. A pioneering EEG study by Rayson et al. (2017) addressed this issue, demonstrating that maternal mirroring (imitation) of an infant's facial expressions (specifically, mouth opening and smiling) at 2 months postpartum predicts stronger mu desynchronization over central electrodes during subsequent observation of the same expressions at 9 months of life. According to the authors, the visuomotor experience afforded by maternal mirroring supports the development of a neural action-perception matching mechanism for faces.

By 3 months of age, metabolic activity increases in the temporoparietal and dorsolateral occipital regions (Chugani, 1994). Near-infrared spectroscopy (NIRS) studies on young infants have documented that activity in the right temporoparietal junction is enhanced in response to social signals, such as human voice and its prosodic components (Grossmann et al., 2010) or contingent gaze during dyadic interactions (Hakuno et al., 2020).

The right temporoparietal junction is a heteromodal association area located at the intersection of the temporal, parietal, and occipital cortexes that serves as a convergence cerebral zone and integrates visual, auditory, and tactile inputs (as in the case of the mother's face, voice, and touch during protoconversational exchanges). This supports the view that multisensory body-related information coming from the intersubjective domain is processed *as a whole* in the infant's right brain (Schore, 2021).

As Schore (2021) has emphasized, during reciprocal and turn-taking preverbal communications, mother and infant "align, synchronize, and match their psychobiological states and then simultaneously adjust their social attention, stimulation, and accelerating arousal to each other" (p. 5). This synchronization occurs at the level of *right brain-to-right brain* communication, physiological state (such as in the case of heartbeat rhythm; Feldman et al., 2011), pupil size, facial expression, and body posture.

By virtue of their "socially oriented" functions, the sensorimotor cortex and the right temporoparietal junction region may be thought of as the cerebral core systems of what Trevarthen calls primary intersubjectivity (Williams & Trentini, 2022). The fact that these cerebral systems are characterized by a general right-hemispheric functional asymmetry is consistent with Schore's perspective about the interpersonal neurobiology of intersubjective processes (Schore, 2021), which are considered "largely dependent upon the right hemisphere resources, which are the first to develop" (Decety & Chaminade, 2003, p. 591).

Taken together, the studies above provide a neuroscience confirmation for an infant's inborn receptive and communicative motivation, the development of which is (in turn) tightly shaped by the responsiveness of the social environment. These investigations also provide substantial evidence of the involvement of mirroring mechanisms in imitative and turn-taking intercourses during the first three postnatal months of development. Nevertheless, it is still not clear whether such mirroring mechanisms account for the ability of young infants to be aware of the intentions of others and also to be emotionally connected with others (Williams & Trentini, 2022). As Heyes and Catmur (2022) have stressed, mirror neurons may be considered as being implicated in low-level processing of observed actions (such as body movement discrimination) rather than in those higher-level cognitive processes (such as joint attention and sharing of intentions and affective states) that emerge—in line with Stern's and Tomasello's perspectives—later in development. Indeed, as we reported above, it is only during the second semester of life that the capacity to engage in triadic (infant-other-object) joint attention interactions emerges (Tomasello et al., 2005). These abilities—which are specific to Trevarthen's secondary intersubjectivity—reflect the infant's emerging understanding of others as intentional agents.

Brain Transformations and Infant Intersubjectivity During the Second Semester of Postnatal Life

Behavioral research has largely documented that at 3 months of life, infants are already able to discriminate between dyadic and triadic joint attention intercourses (Striano et al., 2005). Neuroscience studies have confirmed the precociousness of this ability, showing that— like adults (Frith & Frith, 2006)—, infants recruit the dorsal prefrontal cortex when engaged in joint attention with another person (Grossmann, & Johnson, 2010). Nevertheless, as underlined by Tomasello et al. (2005), the *full understanding* of joint attention is not in place until 9 months of age, maybe by virtue of the more enhanced

metabolic activity that occurs in frontal areas by around 8 months of age (Chugani, 1994).

EEG studies seem to support this assumption, as they have documented greater amplitude in the frontocentral negative component (Nc) of event-related potentials (ERPs) for nine-month-old infants while involved in a joint attention interaction than while involved in non-joint attention intercourse (Striano et al., 2006). It is important to underline that this ERP component, whose amplitude is larger during sustained attention (Richards, 2003), is thought to reflect attentional orienting to salient stimuli (Richards et al., 2010; Striano et al., 2006) and attentional arousal (Soto-Icaza et al., 2015).

Joint attention abilities are considered the basis for the development of the ToM (Baron-Cohen, 1991), which falls within the tertiary layer of intersubjectivity.

Later Development: The Meeting of Minds

According to the embodied simulation framework, ToM relies on the capacity to adopt a simulation routine, which is in turn allowed by mirror neurons (Gallese & Goldman, 1998). Nevertheless, conscious reflection on one's own and others' mental states requires computational resources that go beyond merely the capacity to simulate or imitate an action (Frith & Frith, 1999). For ToM to act, it is necessary that the individual discriminates between personal mental states (i.e., thoughts, desires, intentions, emotions) and those of others. As Decety and Jackson reported (2004), "the development of self- and other- mental-state understanding is functionally linked to that of executive functions" (p. 81). Consistent with this statement, in children with an average age of 3 years, executive functions, especially inhibitory control, are crucial in the emergence and expression of mental-state attribution.

Neuroscience studies have proved that the ToM reliably engages a network of brain regions that are partially overlapping with those involved in executive functions; these regions include the temporoparietal junction and the prefrontal cortex (Wade et al., 2018).

In two separate functional near-infrared spectroscopy (fNIRS) studies, Hyde et al. (2018) evidenced that seven-month-old infants engage the temporoparietal junction, but not prefrontal regions (as medial prefrontal cortex) when viewing events claimed to evoke ToM. These data show the early organization of the cerebral network that is involved in ToM, which is characteristic of early infancy. At this early stage of development, while the temporoparietal junction may be already functionally organized for detecting socio-cognitive variables relevant to ToM, the medial prefrontal cortex might not yet be.

Parental *Preparedness* for Infant Social Cues

Seligman's *theory of preparedness* postulates the ability (observed also in animal species) to respond automatically to cues—particularly those expressing threats—that are critical for survival (Seligman, 1971). Investigations employing audio-visual microanalysis of mother-infant interactions have proved that mothers rapidly modify their behavior in response to the emotional cues of their children (see Trevarthen, 2001). These parental behavioral adjustments have been defined as *intuitive* (that is, faster than controlled conscious responses) because they occur within a temporal interval of 200–800 ms (Koester et al., 1987).

Attuned parental behaviors are primarily activated by the peculiar features of an infant's physiognomy (which is characterized by big eyes, high and protruding forehead, chubby cheeks, and small nose, mouth, and chin) and plump body shape (Hildebrandt & Fitzgerald, 1979). Such features constitute a "baby schema"—or, as postulated by Lorenz (1943, 1971) a Kindchenschema—which represents a biologically relevant stimulus to which adults, especially parents, are highly motivated to respond (Brosch et al., 2007; Glocker et al., 2009). The Kindchenschema is conceptualized as an "innate releasing mechanism" for caregiving behavior

and emotional orientation toward infants (Lorenz, 1943). Notably, proneness to respond and focus attention on infant distress (which is a strong elicitor of caregiving behavior) is already well established in women during late pregnancy (Trentini et al., 2020), predicting enhanced mother-infant bonding during the postpartum period (Proverbio et al., 2011). The fact that parental preparedness is organized during pregnancy obliges us to describe the path women and men go through to become parents.

Transition to Parenthood

During pregnancy, mothers and fathers develop mental representations concerning themselves as parents, the future baby, and their relationships with him or her (Ammaniti, 1991; Ammaniti & Gallese, 2014). These representations build the attachment bond and serve as a sensitive indicator of the caregiving behaviors that parents will put in place after childbirth (Ammaniti et al., 2006; Crawford & Benoit, 2009; Tambelli et al., 2020). The chance of integrating these developmental shifts in a coherent way is related to the personal mental resources that the parents have collected and elaborated during infancy, adolescence, and young adulthood in relation to their own parents and—particularly for women—to their own mother (Bowlby, 1969, 1982).

Prenatal representations are also supported by "primary maternal preoccupation," a very special psychological condition in mothers originally described by Winnicott (1958), which:

> (…) gradually develops and becomes a state of heightened sensitivity during, and especially toward the end of, the pregnancy. It lasts for a few weeks after the birth of the child. It is not easily remembered by mothers once they have recovered from it. (…) This organized state (that would be an illness were it not for the fact of pregnancy) could be compared with a withdrawn state, or a dissociated state. (…) I do not believe that it is possible to understand the functioning of the mother at the very beginning of the infant's life without seeing that she must be able to reach this state of heightened sensitivity, almost an illness, and to recover from it (pp. 301–302).

The concept of primary maternal preoccupation has been empirically confirmed by Leckman and his colleagues (1999), who have explored, in mothers and fathers, parental thoughts and preoccupations about the baby and parental behaviors concerning his or her care from the eighth month of pregnancy to the third month after childbirth. Their observations evidenced a time course of parental preoccupations, with the highest level occurring at 2 or 3 weeks postpartum and with mothers consistently manifesting a higher level of preoccupation for the baby than fathers.

A considerable amount of research has shown that coparenting relationships also emerge during pregnancy. Ammaniti and Menozzi (2021) investigated prenatal coparenting interactions and representations in primiparous couples using an adapted version of the prenatal version of the Lausanne Trilogue Play (PLTP; Carneiro et al., 2006), replacing the doll with a short video of the couples' fetus recorded during their last routine 4D US. In this study, the fetal image triggered some coparenting and intuitive parenting behaviors (such as smiles and baby-talk toward the fetus), indicating the emergence of affiliation processes aimed at recognizing the baby as an individual, to develop a sense of connection with him or her, and to include him or her in the family.

Considering maternal mental dynamics, Stern (1995) conceptualized the "motherhood constellation" as a transient "new psychic organization" (p. 192) that emerges during pregnancy and the period of childbirth, addressing three different preoccupations and discourses that are internally and externally relevant for the mother: one about herself as a mother, one about her own mother, and lastly one about the child.

In this regard, by adopting a psychoanalytical approach, Lebovici has made an important distinction in the mother's mind between the phantasmatic baby and the imaginary baby. Whereas the former appears in maternal dreams as an expression of her unconscious world derived primarily from oedipal conflicts with her own parents, the latter is the conscious image and is frequently shared with the partner, created from their perception of the child or from their wishes

for him or her. These prenatal images will after childbirth interact with the actual baby, stimulating a more realistic representation of him or her (Lebovici & Stoléru, 1983).

During pregnancy, both parents imagine the baby inside the womb as having intentions, feelings, and desires and at the same time recognize their own personal states of mind and emotions. This reflective function is a crucial aspect of the interpersonal experience (Fonagy et al., 2002) because it favors an empathic stance and emotional resonance with the child's emotions and needs after birth. In line with this, Arnott and Meins (2008) have found a positive correlation between mothers' total number of comments in the antenatal demand "describe your child" and their scores for appropriate mind-related comments during infant–mother interactions at 6 months postpartum. A similar result has been evidenced in fathers, although they were less able to discriminate the mental state of the child. The conclusion of this study emphasizes the importance of the maternal and paternal capacity during pregnancy to represent the fetus as a potential and intentional child for future parental mind-mindedness.

Differences found between mothers and fathers in the ability to discriminate the mental state of the baby may be ascribed to the different experiences that mothers and fathers have of pregnancy. The woman's mental experience is *directly* expressed at the body level, mediated by oral and intestinal actions (such as hunger, sense of fulfillment, craving, digesting, and excreting) and by her perception of the baby, whose vitality is manifested through intrauterine movements (Stern, 1995). The father's emotional relationship with the unborn infant is instead *indirect*, experienced via the mother's willingness to share with him the affective and somatic experience of pregnancy. It may be assumed that a father's ability to ascribe mental states to an infant may fully emerge only when he has the possibility to *really* interact with his *real* child.

Neural Underpinning of Parenting

During pregnancy and the post-partum period, dramatic changes also occur in parents' brains that sustain the *preparedness* to detect and attune to infant visual, auditory, olfactory, and emotional cues (Kinsley & Lambert, 2006). In women, these behavioral changes are modulated by the large amounts of hormones secreted during pregnancy and (later) during birth, lactation, and physical contact with their baby (Mayes et al., 2005). Among these hormones, vasopressin and oxytocin have crucial roles in stimulating bonds between mothers and infants (Insel & Young, 2001). Notably, during pregnancy and in the early postpartum weeks, hormonal transformations also occur in men's brains (though to a lesser degree than in mothers), with biochemical profiles that are similar to those of women (Gordon et al., 2010).

Over the past years, a large body of research employing neuroimaging techniques has investigated the neurobiological correlates of maternal and (to a lesser extent) paternal responsiveness to infant cues, including baby cries and emotional faces (Swain et al., 2014). The resulting data indicate that parental brain responses to infant emotional signals are modulated by the connections between highly conserved and automatic brain circuitry (which are similar to those underpinning parental care in rodents) and also by later-evolving paralimbic and cortical structures (Stark et al., 2019).

The subcortical-limbic network implicated in parental behaviors includes the amygdala, the hypothalamus, and the dopaminergic reward circuitry (Feldman, 2015). Along with the hippocampus, the medial preoptic area of the hypothalamus plays a significant role in maternal behaviors, with the former modulating memory and learning and the latter sustaining the initiation of maternal behavior. Research has shown that during the early postpartum period, gray matter volume increases in the maternal midbrain (including the hypothalamus and substantia nigra) and the amygdala: notably, this increase correlates with maternal positive perception of the infant, thus evidencing a link between

neurobiological plasticity and parental affective representations (Kim et al., 2010). These structures are strictly connected to the paralimbic and cortical networks that are implicated in higher-order socio-affective processes—such as empathy, mentalizing, and emotion regulation—which will be illustrated in this section.

In past years, our research group used functional magnetic resonance imaging (fMRI) to explore brain responses in mothers while observing/empathizing or imitating the emotional expressions (joy, distress, ambiguous, and neutral) of their own child and those of an unfamiliar child (Fig. 14.1) (Lenzi et al., 2009). We found that the mirror neuron system, the insula, and the amygdala were more active during emotional expressions; moreover, this circuit was engaged to a greater extent when mothers were interacting with their own children (Fig. 14.1). Notably, the right anterior insula response positively correlated with maternal scores on the Reflective Functioning Scale (Fonagy et al., 1998), which provided a measure of maternal ability to ascribe mental states to an infant. The insula, which is a detection center for arousal and salience of emotional stimuli (LeDoux, 2003), serves as a relay between the frontal components of the mirror neuron system (which provides a motor representation of the observed or imitated facial expression) and the limbic system (which is involved in emotion processing) (Carr et al., 2003). In this manner, motor representations of others' facial expressions are translated into their emotional significance, which can in turn be *simulated* at the body level (Gallese, 2003). In our study (Lenzi et al., 2009), joy expressions evoked a response mainly in limbic and paralimbic areas; in contrast, ambiguous stimuli elicited a response in left high-order cognitive and motor areas, which might reflect the stronger cognitive effort required to decode the exact emotional meaning of such facial expressions. The results of this study support the hypothesis that the mirror neurons-insula-limbic system (above all in the right hemisphere) is activated to a greater extent in mothers who have a greater ability to recognize and interpret their infants' emotional experiences in a meaningful way.

The cortical mentalizing network—which comprises the superior temporal sulcus/gyrus, the precuneus, the posterior cingulate cortex, the temporoparietal junction, and the ventromedial prefrontal cortex (Paul et al., 2019)—allows parents to infer and interpret infant mental states (e.g., intentions, motivations, and feelings) (Feldman, 2015). These processes are fundamental to enabling parents to respond to infant cues sensitively through activation of the emotion

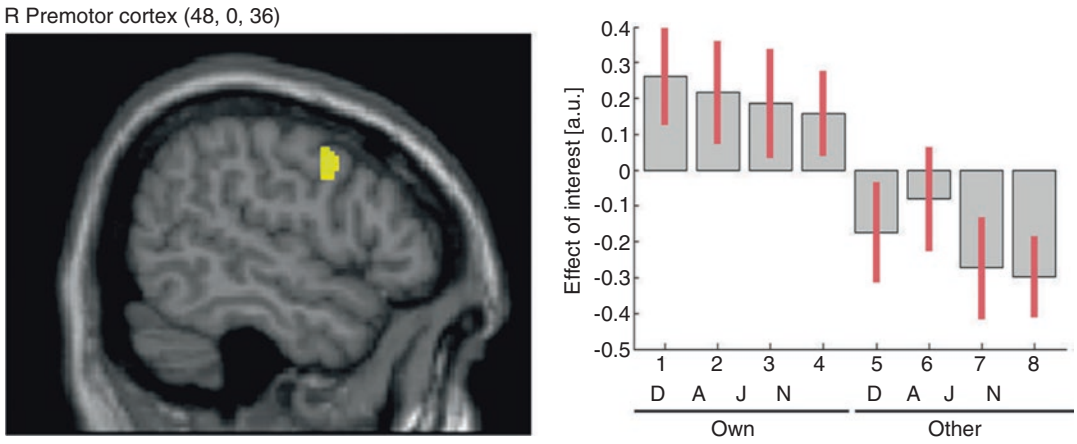

Fig. 14.1 Observing/empathizing: Own child > other child. The figure shows the right ventral premotor cortex, which is one of the areas with mirror-like properties that are activated to a greater extent during observation of a mother's own child than of someone else's child (*D* distress, *A* ambiguous, *J* joy, *N* neutral. Source: Lenzi et al., 2009)

regulation and executive network, which includes the frontopolar cortex, dorsolateral prefrontal cortex, medial frontal gyrus, and orbitofrontal cortex (Nitschke et al., 2004).

Among these areas, the orbitofrontal cortex has great relevance in parenting as it is involved in socio-emotional behaviors and affects the regulation processes underlying attachment bonds (Ammaniti & Trentini, 2009; Schore, 2021). The orbitofrontal cortex (particularly its medial part) also has a crucial role in modulating adults' affective propensity toward infants, since it responds after only 130 ms from the presentation of infant faces (Kringelbach et al., 2008). Based on this evidence, it has been suggested that this cerebral area is "a potential brain basis for the "innate releasing mechanisms" described by Lorenz for affection and nurturing of young infants" (Kringelbach et al., 2008, p. 5).

Summary and Key Points

At birth, infants show a sophisticated behavioral repertoire that serves their need to attune to the subjective experience of others. These dispositions have their antecedents in a "motor intentionality" that emerges during the intrauterine period. The infantile pathways we have drawn describe the critical steps that, from early infant-parent interactions and affective attunements, move in subsequent semesters to more complex forms of intersubjectivity, influencing the developmental trajectories of brain structures and functions. These new acquisitions enable the infants to recognize intentions, motivations, and the affective states of another's mind. During the life cycle, these fundamental acquisitions become more sophisticated and multifaceted, facilitating the understanding of others' being in the world, according to the conceptualization of the German philosopher Martin Heidegger (Zahavi, 2001).

From a transactional perspective, studies on intersubjectivity may contribute to planning and performing preventive programs starting from pregnancy and until the first years of postnatal life. Moreover, research in this domain may further enrich the therapeutic dynamics of clinical interventions for children and parents in psychopathological risk conditions.

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Part III

Parenting and Caregiving

Parenting and Caregiving

15

Joy D. Osofsky

This section of the *WAIMH Handbook of Infant and Early Childhood Mental Health* focuses on Parenting and Caregiving, a topic that is crucial for infant and early childhood development. As Donald Winnicott shared many years ago, "there is no such thing as a baby... a baby cannot exist alone but is essentially part of a relationship" (Bonaminio & Fabozzi, 2016; Handling, 2023, p. 88). The quality of parenting that a child receives is one of the most important factors influencing development (Collins et al., 2000). In this section, a range of issues for parenting and caregiving are described beginning with the importance of the attachment relationship and ways to understand and enhance child and parent/caregiver interactions. Chapters also consider risk factors for the early relationship that influence infant development and the growing relationship including disorganized attachment, exposure to trauma, substance use, adolescent parenting, and other factors. Importantly, this section on parenting and caregiving includes fathering as well as mothering, a cross-cultural consideration of co-parenting and intergenerational parenting, and parents of diverse gender identities. We also learn about the importance of integrating infant and early childhood mental health into pediatric practice and primary care reaching out to young children and parents or caregivers using a population health perspective and behavioral health prevention.

In the first chapter, Thompson reviews central ideas and findings about attachment theory that are central for understanding parenting and caregiving. He shares information about caregiver sensitivity and relational security which are important to understand in relation to attachment including caregiver sensitivity and emotional availability that contribute to psychological well-being. He continues to describe attachment as a relational construct and considers multiple attachments and the impact of relationships on relationships. The chapter contributes to the reader's understanding of both prevention and treatment programs by elaborating on attachment-informed early childhood mental health. Paquette and Puentes-Newman in Chap. 17 emphasize the important role of fathers and their children from the perspective of the Activation Relationship. While they agree that parent-child intervention has been guided by attachment theory, they also emphasize that the issue of parental competence has mainly been considered from the perspective of the mother-child relationship. They continue by stating that the absence of a theory-driven model of fathering has led to a lack of specific interventions focusing on the important father-child relationship. However, they assert that with the development of the activation relationship theory in 2004,

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more theoretical ideas have been developed and research done about different ways to intervene with fathers. In this chapter, they share the emergence and development of the activation relationship theory and describe and consider an early intervention program involving father-child dyads. Expanding on understanding of attachment theory, Beebe in Chap. 18 provides a view from microanalysis by sharing drawings of the origins of disorganized infant attachment. Using microanalysis, her work provides more details of the process of mother-infant communication than can be seen using observational data. In her chapter, she illustrates this approach with drawings of the findings from research on the 4-month origins of 12-month disorganized (vs. secure) attachment. Using microanalysis of film frames that disguised the identity of the mothers, she illustrates how through emotional and bodily expressions, they were able to identify the origins of secure attachment and disorganized attachment. Beebe shares that this careful analysis can be used to guide a more thorough understanding of relational function and help develop clinical interventions.

The next chapter by Hennigar and Cabrera presents an additional perspective on the important influence of fathers on infant development. They synthesize the available empirical evidence, primarily from the United States, about the influence of fathers on children's development during the first 3 years of life. Using a careful theoretical and methodological approach, they share available evidence on theoretically based conclusions about father effects. Then they present empirical evidence on fathers' direct impact on children's social and emotional, language, cognitive, preacademic, and physical development. An important component of their work is to share individual and family-level characteristics that explain variations in fathering behaviors. After the two chapters that focus on fathers, McHale in Chap. 20 discusses co-parenting theory, research, and practice emphasizing that around the world from different cultural perspectives, infants and toddlers are cared for and socialized in multi-person family collectives. The experiences of young children in multi-person families may differ in relation to adult participation, containment, and teamwork in dealing with and responding to child-related conflict. A multiple family-level environment and atmosphere can be experienced by children as protective but also confusing at times. McHale emphasizes there is now further readiness of professionals to assess co-parenting and to pay more attention to its importance and developmental impact.

Parenting and caregiving also include high-risk situations such as adolescent parenthood that can bring multiple developmental challenges for mothers and young children described in Chap. 21 by Sydney Hans. While young mothers often experience economic hardship, difficulties with permanent housing, and social stigma, it is also important to understand the positive aspects of adolescents as young mothers. Hans examines the supports and stressors adolescent mothers experience with their families, in relation to the children's fathers, and from institutions designed to help them. Also described are infant mental health programs that have been successful in supporting young parents. Another topic considered about parenting and caregiving by Patterson in Chap. 22 relates to parents' sexual orientation and continues to be controversial. Lesbian, gay, bisexual, transgender, and queer (LGBTQ) adults are also parents. Questions have been raised about whether LGBTQ adults can be capable parents and if their children grow up in healthy ways. Considered in this chapter are the factors that contribute to positive functioning and development for children with LGBTQ parents. Findings from social science research suggest that LGBTQ parents are successful in their roles as parents and their children grow up in positive ways. This work is important as research has shown that sexual orientation and gender identity do not in themselves influence success in parenting or child development. Implications of research findings for law and policy around the world are discussed.

Moving to understand a different perspective and approach to parenting and caregiving, Campbell and colleagues in Chap. 23 explain the

role of mentalization in infant development. Mentalizing caregivers respond with contingent and marked affective displays of their own experience in response to the child's subjective experience enabling the child to develop second-order representations of his or her own subjective experiences. Further, the development of mentalizing for the infant and young child may help them develop openness to cultural learning supporting social functioning. Another perspective on parenting is presented by Broesch in Chap. 24 focusing on mutual joy and socialization between caregivers and infants that occurs across cultural boundaries.

She shares that mutual joy and shared social interaction provide the foundation from which the infant develops a sense of agency, identity, and self-worth.

Although not always emphasized sufficiently, Briggs and colleagues in Chap. 25 describe the Healthy Steps model as a unique opportunity for prevention and intervention by sharing and integrating in the pediatric and primary care arenas principles of Infant and Early Childhood Mental Health (IECMH) to reach a broad range of children and families. The Healthy Steps Model described in this chapter adapts the IECMH framework to the pediatric and primary care setting by using competencies aligned with the IECMH consultant work and principles from both population health and behavioral health prevention.

Returning to concern about high-risk populations, in Chap. 26, Jones Harden, Osofsky, and Alexander focus on the effects of trauma on parenting and caregiving which can range from a young child experiencing an accident to abuse and neglect. Evidence indicates that high rates of maltreatment have been associated with immediate and long-term impairments in mental and physical health and that experiencing trauma can have a deleterious effect on parenting. Further inequities are apparent related to available support which has been shown to be important to improve mental health and capacity to support children.

Tronick and Hunter in Chap. 27 emphasize the need to rethink early childhood trauma as a developmental process rather than having a dominant psychopathological perspective. They argue that the lack of a developmental process diminishes the value of trauma theory and the effectiveness of trauma-informed processes. Rather, they suggest that a guide for therapy for both children and adults exposed to trauma would be to consider the development of meaning. Then a therapeutic approach following trauma would effectively let the individual control the process that is implemented in multiple ways that engage every level of functioning.

In Chap. 28, Kelm, Level, and Eiden address the important issue of parental substance use and abuse that impacts not only negative parental behaviors and exposure to different types of traumatic experiences for young children, but also the teratogenic effects of prenatal exposure on the young child's development. More positively, they consider current and future directions for early intervention.

Summary and Key Points

The section on Parenting and Caregiving begins with a consideration of the importance of the attachment relationship for the infant and young child's development that will impact whether development goes well or contributes to significant risk factors. We learn more about new ways to study secure and disorganized attachment using microanalysis. Risk factors are detailed in several chapters in this section, including the effects of trauma on development, substance use, and the increased risk factors of adolescent parenting. Another chapter also considers a reconsideration of early childhood trauma as a dynamic developmental process. This comprehensive section related to parenting emphasizes the importance of fathers, co-parenting, and the impact of intergenerational parenting on infant and early childhood development. As a part of the emphasis on the importance of early intervention, there is also a suggestion to expand the reach of infant and early childhood mental health by integrating mental health concerns in multiple disciplines including pediatrics and primary care. This section

emphasizes that broadening an understanding of parenting and caregiving in infancy and early childhood to support positive attachment relationships may be done in many different ways to benefit young child development.

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Attachment Theory and Early Childhood Mental Health

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Ross A. Thompson

Attachment theory and the field of infant mental health have developed together during the last 40–50 years. This is no accident. Bowlby's interest in early parent-child relationships derived from child clinical concerns, crystallized in his study of *Forty-four Juvenile Thieves,* many of whom suffered from prolonged separation from their mothers before the age of five (Bowlby, 1944). This led to his view that the infant's experience in close relationships contributes to potentially enduring representations of self and others that shape future relationships, personality, and psychological well-being. It is difficult to think of infant and early childhood mental health without the catalyst of attachment theory; it is difficult to think of attachment theory without the continuing catalysts of work in early childhood mental health.

My goal in this chapter is to describe some of the seminal contributions of attachment theory to current thinking about early childhood mental health. These contributions derive, in part, from foundational research on attachment formation and development, including the influence of attachment on socioemotional and personality development, the internal working models that are thought to mediate these associations, and attachment viewed in the context of cultural diversity. These contributions also derive from ideas in attachment theory that have influenced early clinical assessment and intervention, including the importance of infants' and parents' mental representations of relationships, attachment as a relational construct, the recognition of multiple attachment relationships and the impact of relationships on other relationships, and parental sensitivity as a central avenue in the development of secure attachment. As other chapters in this *Handbook* document, these ideas have had a significant and longstanding influence on the field of infant and early childhood mental health.

Before embarking on a discussion of this scope, let me draw the reader's attention to other resources that provide greater depth and perspective. Prominent among these is the third edition of the *Handbook of Attachment: Theory, Research, and Clinical Applications* (Cassidy & Shaver, 2016), *Attachment: The Fundamental Questions* (Thompson et al., 2021), and the *Handbook of Attachment-Based Interventions* (Steele & Steele, 2018). Beyond these, the references cite other foundational materials and edited volumes that can provide further background on these topics.

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Fundamentals of Attachment Theory

Attachment theory portrays infant-parent attachment as a species-typical adaptation evolved to promote infant survival and eventual reproductive success. In a manner analogous to imprinting in precocial birds and related behavioral processes in mammals, attachment between infant and adult helps to establish and maintain proximity between them to enable protection and nurturance by the adult and confident exploration and learning by the infant. Although this was a novel portrayal of attachment formation in developmental science when Bowlby (1969) developed his theory, this view was uncontroversial to psychologists who were familiar with evolutionary views of human development. It is consistent with a variety of contemporary adaptationist frameworks, such as life history theory (Del Giudice, 2009).

Viewing attachment in this manner raises certain problems for attachment theorists, however, in their encounters with cultural psychologists. If attachment is a species-typical adaptation, does this mean that a secure attachment is also species-typical? How does this view accommodate cultural variability in early care and its consequences (see, e.g., Keller, 2021)? Questions such as these are the basis for continuing debate between attachment theorists and their cultural critics. Contributing to this debate is increasing empirical evidence that attachment is species-typical, that sensitive parental care is important to the development of attachment, and that there is cultural variability in how attachment develops, in the manifestations of sensitivity, and in the processes that promote infant survival and the development of culturally relevant competencies (Thompson, 2017).

The interest of attachment theorists, particularly Ainsworth, in *security* is an important foundation of the theory (Ainsworth et al., 1978). Attachment theory posits that a behavioral system like attachment that evolved to ensure the protective proximity of the infant to caregivers would be manifested primarily in the security derived from the adult's presence. This felt security enables the adult to function as a secure base for the infant's exploratory forays, as well as a haven of safety when the child feels threatened or alarmed (see Chap. 12 by Kolacz and Porges, this volume). The emphasis of attachment theory on security is in contrast to other viewpoints that would be more interested in the "strength" of attachment or its "resilience" or "robustness," or the "warmth" of the attachment relationship. These are not necessarily the same things as security.

Why do infants develop secure attachment? From the beginning, attachment researchers have followed Ainsworth in viewing caregiver *sensitivity* as a core contributor to a secure attachment because of the support that sensitive responsiveness provides the infant in both distressed and nondistressed contexts (e.g., Ainsworth et al., 1974). Sensitive responsiveness consists of appropriate and prompt responses to infant needs, and is believed to be predicated on an adult's attuned representations of the child's mental and psychological experience (a process generally called *mentalization)* that supports responses that are true to the infant's needs (Fonagy & Target, 1997; Zeegers et al., 2017). Responding with sensitivity is not, in other words, a scripted response, but requires reflective consideration of the immediate internal experience of the other person.

Generally, research findings have supported the association of sensitivity with security. Reviewers have found this association to be modest (De Wolff & van IJzendoorn, 1997) to fairly strong (Verhage et al., 2016). One reason for this variability may be that sensitivity has been measured by attachment researchers in a variety of ways, with different measures focusing on the contingency of caregiver response, its appropriateness, the adult's warmth, positive mutuality between adult and baby, the synchrony of dyadic interaction in social play, and other characteristics. This diversity in measurement, especially when measures depart significantly from Ainsworth's original conceptualization of sensitivity, may reduce the predictive power of the sensitivity construct (De Wolff & van IJzendoorn, 1997; but see Berlin & Cassidy, 1999, for an alternative view).

Some of the ways that sensitivity is measured by attachment researchers have motivated critics to argue that the sensitivity construct reifies a style of care that is more consistent with parental behavior in wealthy Western democracies than in low- or middle-income agrarian communities (Keller et al., 2018). Not all parents worldwide respond with warmth in ways that would be apparent to a Western audience; not all engage in verbal interaction or face-to-face play; in many cultures, mothers are one of a range of infant caregivers, not the sole parenting figure. Researchers like Mesman have argued, however, that when researchers maintain fidelity to Ainsworth's original and narrower conceptualization of sensitivity -- one that focuses on the appropriateness and promptness of the response to infant needs -- and accommodate culturally-specific practices of care, universal evidence of caregiver sensitivity that contributes to infant development can be observed even in multi-caregiver contexts (Mesman et al., 2017).

This debate has sensitized attachment researchers, however, to the distinction between theoretical portrayals of sensitive parenting and the familiar cultural practices of Western parents. If sensitivity can be manifested in culturally specific ways, this diversity in parenting practices should be recognized. This is an especially important principle in therapeutic intervention, as well as for preventive programs of parent support, including home visitation and social service. The evaluation of parenting practices according to familiar Western preferences may neglect attention to alternative practices that manifest sensitive care in culturally specific ways, especially when parents from immigrant and minoritized groups are concerned.

If sensitivity is a reliable predictor of the security of attachment, what other influences are also important? Stresses on the family may be one, such as from economic need. There is evidence that sensitivity is a stronger predictor of attachment security in middle-income homes than in lower-income homes, which may reflect the impact of stresses on parent-child relationships (Fearon & Belsky, 2016). Raikes and Thompson (2005) extended this view by showing, in a lower-income sample, that *economic* risk factors were associated with lower maternal responsiveness which, in turn, contributed to insecure attachment. However, *emotional* risk factors (e.g., domestic violence and anger problems in a family member) had a direct effect on the security of attachment that was unmediated by maternal responsiveness. These emotional risks are likely to alter the broader emotional climate of the family and thus directly affect the child's security through the behavior of other family members, such as by affecting the quality of the marital relationship. This conclusion is consistent with the views of Emotional Security Theory, which argues that in addition to their secure or insecure relationships with parents, children also derive security (or insecurity) from the warmth or conflict in parents' marital relationship (Davies & Martin, 2013). Current evidence indicates that children who witness frequent or intense marital discord experience distress, develop negative representations of interparental relationships, and are at elevated risk for affective psychopathology. Thus the broader climate of the family, as well as parental sensitivity, can influence the security that infants and young children derive from attachment relationships.

The security of attachment can change over time, especially as changes occur in family circumstances (such as increased stress or changed caregiving conditions) that can also impact parental sensitivity (Booth-LaForce & Roisman, 2022). Although some children develop security in the infant-parent relationship that endures over years, for others the security of attachment can change over a period of months or years, especially as changes occur in family conditions (such as divorce). Stated differently, the continuing support of parental care is necessary for early secure relationships to remain secure (Egeland & Farber, 1984; Manning, 2019). The dynamic quality of attachment relationships is a therapeutic resource because it means that when early attachments are insecure, they can change to become more secure in response to the development of a more supportive parent-child relationship, such as may result from improved family circumstances or therapeutic assistance.

As Bowlby and Ainsworth expected, the security of attachment influences children's subsequent development (Thompson, 2016). Most directly relevant to attachment theory are findings indicating that a secure attachment in infancy foreshadows a more positive parent-child relationship in the years immediately following. Securely-attached children have also been found to develop greater social competence in relationships with peers and other partners, both with casual acquaintances and close friends, perhaps owing to their greater social skills and expectations compared to insecurely-attached children. Security of attachment is also associated with personality development, with secure children exhibiting greater confidence and more positive self-concept, stronger emotion regulation skills, more advanced conscience (or early moral) development, and other indicators of emotional health. Security of attachment has also been found to be associated with social cognition; for example, secure children are stronger in emotional understanding. Taken together, and in a manner that is rare for early measures of social-personality functioning, the security of attachment is associated with a broad range of theoretically predicted developmental outcomes, especially when those outcomes are measured contemporaneously with or close in time to the attachment assessment. Over much longer spans of time separating attachment and its expected outcomes, the strength of their association is weaker (see review by Thompson, 2016).

The reasons for these associations between attachment security and personality functioning bear examination. In infancy and early childhood, there is evidence that they derive, in part, from the continuing influence of sensitive parenting (Sroufe et al., 2005). Stated differently, the developmental benefits of a secure attachment early in life derive partly from the ongoing security of the relationship because sensitive care continues to support a young child's social competence, emotional health, and other characteristics as well as attachment security. In addition, some studies suggest that early secure or insecure attachment moderates other parental influences (such as discipline practices) that help to create a continuing cascade of compounding positive or negative influences on the child's growth (Kochanska et al., 2019). One study showed, for example, that responsive parenting in early childhood predicted children's conscience development at 56 months for securely-attached children, but for insecurely-attached children, there was no such association (Kochanska et al., 2004), With increasing age, the relational influences that have been shaped by secure or insecure parent-child relationships can have cumulative effects on the development of personality, social cognition, and other aspects of children's development (Thompson, 2016).

As children mature into adolescence and adulthood, the continuing effects of early security become manifested indirectly as they are mediated by subsequent relational influences, such as experiences in romantic relationships. Attachment researchers have recognized, therefore, that later personality, social competence, self-confidence, and other characteristics are best predicted by the influence of early attachment in concert with later developmental influences (e.g., Sroufe et al., 2005). Stated differently, children's characteristics are a product both of current experience and developmental history.

There is another reason that early attachments influence developmental outcomes: the mental representations created by a secure or insecure attachment. Bowlby called these mental representations *internal working models* (IWMs), and his portrayal of these integrative, affectively colored, dynamic mental representations of relationships and the self is one of the most theoretically generative concepts of attachment theory. IWMs constitute an essential bridge between attachment security and later behavior by linking them in a network of representational processes. These representational processes include understandings of relational partners, conceptions about the self, and beliefs about how to interact with other people.

Bowlby created the internal working models concept by marrying the concept of mental maps of a physical landscape from cognitive psychology with concepts of the introjected qualities of caregivers from object relations theory. In

his portrayal, IWMs are developing representations of relationships and the self, derived and refined from experience, that influence other facets of social and personality functioning. They originate in the rudimentary expectations for the responsiveness of attachment figures in early infancy and later broaden to incorporate a growing understanding of the caregiver's goals and perspectives which children can coordinate with their own goals. In attachment theory, IWMs also account for the defensive exclusion of information that threatens attachment, as well as the selective processing of information that is congruent with the child's prior secure or insecure working models. Stated differently, IWMs are believed to constitute interpretive filters through which children and adults reconstruct their experience of new relationships in ways that are consistent with past experience and expectations. This helps to account for how secure and insecure children respond differently to new partners in ways that are consistent with their past relationship history, eliciting responses that help to confirm what children have expected all along. Viewed in this light, it is also easy to see how IWMs become more complex with psychological development, incorporating the lessons of more diverse relationships and experiences, but also building more comprehensive representations of relationships and the self to guide adult behavior.

Unfortunately, Bowlby's treatment of IWMs as a conceptual idea rather than a fully developed theoretical construct has limited the usefulness of this concept because of its vague definition (Thompson, 2021). In one sense, IWMs can be used to explain how attachment is associated with almost anything because of the breadth of how Bowlby conceived an internal working model, and subsequent attachment researchers have not added clarity concerning its defining features. It remains unclear, for example, whether IWMs function unconsciously or are consciously accessible, whether multiple working models exist for different attachment figures or whether they are consolidated into a single, comprehensive working model, and how IWMs connect with well-known concepts outside of attachment theory like social expectations, social scripts, expectancy biases, self-confirming prophecies, confirmation biases, and processes of constructive memory. Consequently, although attachment theory emphatically underscores the importance of mental representations of relationships to the development of attachment security and its outcomes, it is much less clear about the nature and functioning of those representations. As the discussion that follows documents, however, the concept of mental representations of relationships has generated some of the most interesting and creative thinking and research in the attachment field.

Attachment and Early Mental Health

These fundamentals provide the theoretical structure within which ideas and applications to infant and early childhood mental health have developed. In this section, I explore these applications from attachment theory in greater detail.

Varieties of Insecurity

With the development of the Strange Situation procedure for assessing the security of attachment in infancy (Ainsworth et al., 1978), researchers have been able to study the developmental outcomes of secure attachment and several kinds of attachment insecurity. Whereas *securely attached* infants are distinguished by their comfortable exploration in the caregiver's presence, even after a distressing separation, and their pleasure in relating to the caregiver, the behavior of infants deemed insecurely attached reflects their diminished experience of the adult as a secure base. *Insecure-avoidant* infants show little apparent interest in the caregiver, for example, even after the heightened activation of the attachment system by their separation, and they reveal little reliance on the adult's presence to provide security. *Insecure-resistant* infants, by contrast, seem entirely preoccupied with the caregiver, even before separation, but the adult

seems to confer little security because these infants do not comfortably explore or show marked pleasure in the adult's presence. Attachment researchers believe that all three groups -- secure, avoidant, and resistant -- have developed strategies for interacting with the adult based on their prior experience of sensitive or insensitive care and their representations of the reliability of the caregiver's responsiveness. However, a fourth insecure group, *disorganized* infants, even seem to lack a coherent strategy for interacting with the caregiver because their behavior in the Strange Situation seems disoriented, sometimes fearful, and they may act securely, avoidantly, and/or resistantly in an inconsistent fashion. These infants are not only insecure but also disorganized in their attachment strategy.

One of the remarkable characteristics of this multifold classification system is that it has remained the gold standard for characterizing attachment over several decades of research. As new measures of attachment have been developed for older children and adults, these measures have relied on the same multidimensional portrayal of security and insecurity. Even adult measures of attachment distinguish adults as autonomous (resembling the infant secure classification), dismissing (avoidant), preoccupied (resistant), or unresolved (resembling infant disorganization), or they characterize adult relationships as anxious (resistant) or avoidant, or they globally distinguish between secure and insecure adults (Crowell et al., 2016). In relying on the same attachment groups developed for the Strange Situation in infancy to characterize attachment in later developmental periods, attachment researchers seem to regard the organization of attachment as remaining consistent despite changes with age in cognition, social understanding, and relationships (but see Crittenden, 1992, for a different view).

The varieties of insecurity identified in infancy and early childhood are also associated with risk for psychopathology. According to meta-analytic findings, early avoidant attachment is associated with elevated risk for both internalizing (e.g., anxious, depressed) and externalizing (e.g., disruptive, aggressive) problems, whereas resistance is not significantly associated with heightened risk in either symptom domain. Early disorganization places children at the greatest risk for externalizing, but not internalizing problems (Groh et al., 2017). There is also a reliable association between disorganized attachment and child maltreatment (Cyr et al., 2010) and between disorganization and "anomalous" or disrupted parental behavior, such as the caregiver's mixed emotional communication, role confusion, and fearful or frightening conduct (Madigan et al., 2006). Thus different forms of insecurity have different risk profiles, while secure attachment is a protective influence against the risk of early psychopathology.

However, it is important to recognize that the effect sizes indicated in these studies are modest (with effect sizes ranging from under 0.15 to 0.31). Taken alone, therefore, insecure attachment is certainly not prognostic of psychological difficulty. Instead, it is best understood as one risk factor among many that potentially contributes to the development of psychopathology.

Even so, understanding why the risk for psychopathology accompanies different forms of insecure attachment requires integrating the understanding of how these varieties of insecurity have developed. Clearly, and most obviously with respect to disorganized attachment, disturbed or disordered parenting practices assume a major role, most notably when children are abused, neglected, or psychologically maltreated. Even when parenting is not manifestly disturbed, a young child's diminished confidence in an adult's reliable solicitude deprives them of critical social support. Furthermore, research on the outcomes of secure and insecure attachment has shown that in secure relationships, young children acquire skills in emotional self-regulation (owing in part to the parental support and guidance they receive), they become more self-confident, and they acquire social skills (such as social problem-solving strategies) and fewer social liabilities (such as diminished hostile attribution biases) that support more constructive relationships with others (see review by Thompson, 2016). Weaknesses or liabilities in

these areas likely contribute to psychological vulnerability for insecurely-attached children. Finally, attachment theorists believe that young children's developing working models (IWMs) of themselves and others in relationships contribute to expectations of being disliked, ignored, or rejected, and consequently feeling distrust and anxiety, which can impair other relationships beyond parent-child attachment. All of these influences can potentially contribute to the risk for affective psychopathology, especially as they interact with each other and have cumulative effects beginning from infancy when psychological development is taking shape. As Kochanska et al. (2019) have proposed, insecure attachment may be at the center of an early and continuing cascade of compounding negative influences on psychological growth.

To summarize, while there is a consistent profile of secure attachment, there are multiple profiles of insecure attachment that are based on differences in caregiver responsiveness and parenting quality, the psychological characteristics that are strengthened (or weakened) in young children by the quality of attachment, and the representations of self and relationships associated with security or insecurity. Longitudinal research is beginning to document the interactive and cumulative effects of these attributes of attachment relationships over time. These findings make the portrayal of a "developmental cascade" inaugurated by early security or insecurity a potentially useful model for understanding its relevance to risk for affective psychopathology (Masten & Cicchetti, 2010).

Infant and Parent Representations of Relationship

As noted earlier, attachment theorists believe that the security of attachment is associated with the child's development of mental representations (IWMs) of other people, the self, and relationships that grow in psychological complexity and influence social interactions and self-regard. Because these representations are life-long, researchers have also distinguished adult secure and insecure representations -- or "states of mind" -- with respect to attachment. These are typically assessed in the Adult Attachment Interview (AAI), a semi-structured interview in which adults are asked to discuss their memories of childhood care and the influences of these experiences on them (Hesse, 2016). Whereas infant security of attachment is based on behavior reflecting a child's representations of the caregiver as a secure base, secure states of mind are revealed in the AAI through interview responses reflecting an adult's valuing attachment relationships and viewing these relationships as influential, as well as a discourse that is coherent and consistent. The attachment categories deriving from the AAI were briefly mentioned earlier because they closely resemble the attachment categories of the Strange Situation. Adults deemed *autonomous* (secure) describe their early experiences of care as important, even when those experiences have sometimes been difficult rather than supportive, and they can discuss them in a balanced and objective manner. Adults classified as *dismissing* (resembling insecure-avoidant infants) devalue the influence of attachment, and they may idealize their attachment figure but also exhibit memory gaps for critical childhood experiences. Those considered to be *preoccupied* (insecure-resistant) appear overwhelmed by their past attachment experiences as reflected in their enmeshment with and anger toward the attachment figure. Finally, a small proportion of adults are considered *unresolved* (resembling infant disorganization) if their responses become disorganized or inconsistent when discussing the loss of a loved one.

Adult attachment states of mind are important for at least two reasons. First, they are manifestations of the mature representations that may be related to early experiences of care. Second, these representations influence other relationships, such as with a marital partner or child. For example, attachment states of mind affect a parent's care of the infant because of how the caregiver's security influences their attention to and interpretation of the infant's signals and needs. An insecure adult's self-engrossment or dismissing regard of attachment, for example, would

likely blunt sensitivity toward an infant. This would make it more likely that an infant cared for by an insecure adult would also become insecurely attached and potentially experience other vulnerabilities to developing psychological well-being.

There has been considerable interest by attachment researchers in the parental mental states that influence the parental behavior that affects the development of attachment security. A small early study of 27 children and their parents, for example, included measures from the Adult Attachment Interview of parents' state of mind. These measures predicted kindergarten teachers' ratings of children's externalizing and internalizing behavior, and these associations were mediated by observational measures of parent-child interaction and marital harmony (Cowan et al., 1996). Mothers and fathers with more negative representations of their early experiences of care from the AAI exhibited poorer marital and parenting quality that, in turn, was associated with children's heightened internalizing and externalizing behavior.

Attachment researchers have characterized parental representations of the child in various ways, and these representations have also been found to be associated with the quality of parental care and the attachment security of children. One is parental *reflective functioning*, an operationalization of mentalization, which can be measured in several ways, including the Parent Development Interview (PDI), a semi-structured interview designed to examine parents' representations of their children and themselves as parents. Mothers who showed high levels of reflective functioning on the PDI demonstrated a strong capacity to reflect on the child's mental states as well as their own, and how those mental states are manifested in behavior. Mothers with high levels of reflective functioning on this measure were more likely to have securely attached infants and were themselves more likely to be deemed autonomous on the AAI (Slade et al., 2005). These findings are similar to those on parental *insightfulness*. Parents are deemed high in insightfulness when they are able to talk about the motives that underlie the child's behavior in an open, accepting, and empathic manner. Insightfulness is assessed when parents are interviewed about their responses to video recordings of their child's behavior and asked to interpret what they view. Several studies have shown that parents high on insightfulness are more sensitive in their interactions with their infants who are, in turn, more likely to be securely attached (Oppenheim & Koren-Karie, 2021). A related construct, parental *mind-mindedness,* is assessed by evaluating an adult's spontaneous commentary while playing with their infant. Appropriate mind-minded comments refer to the child's emotions, preferences, motives, goals, and other mental states in a manner that is suitably connected to the infant's behavior. A number of studies have shown that high levels of mind-mindedness are associated with sensitive responsiveness and with the infant's security of attachment (McMahon & Bernier, 2017).

Taken together, across different measures and contexts, variability in parents' capacities for child-oriented mentalization -- to frequently and accurately represent the infant's internal states -- is reliably associated with the sensitivity of parental care and with the security of attachment in offspring (Fonagy & Target, 1997; see also Chap. 24 by Fonagy et al., this volume). Indeed, a meta-analysis of this research literature indicated that child-oriented mentalization is directly associated with the child's attachment security to a comparable extent as parental sensitivity and that it also has indirect associations with the security of attachment through its influence on sensitive responsiveness (Zeegers et al., 2017). Mentalization is thus an important foundation for sensitive responding by contextualizing sensitivity in an attuned, receptive attentiveness to the child's mental and emotional experience of the moment. It is connected to a parent's attachment representations by the ability to think of one's own internal experience as valued and important, and extend that appreciation to others.

One implication of these findings is that to attachment theorists, efforts to strengthen parent-child relationships and improve the quality of care should include attention to the adult's representations of the child and of the self. Behavioral

coaching and improvements in parents' knowledge and skills, as valuable as these can be, must be complemented by attention to how an adult perceives and interprets the child's psychological experience in the course of their interaction. Equally significant is the attachment view that differences in mentalization arise from the adult's representations of their experience of past care in significant relationships. These representations may not be direct portrayals of their actual experiences of childhood care but, as representations, are internalized models of relationships in which feelings, motives, and needs are interpreted and valued. These internalized models extend to the adult's interactions with their own offspring. As I describe later, different attachment-informed therapeutic strategies vary in the extent of their attention to these mental representations, but none are inconsistent with furthering the adult's reflective functioning.

Intergenerational Transmission of Attachment

The association of an adult's child-oriented mentalization with the quality of parental care and with the child's attachment security is consistent with the expectation that parental attachment representations influence sensitive responsiveness (Cowan et al., 1996). In several of the studies summarized above, measures of parental mentalization were obtained prior to assessments of sensitivity and infant attachment. The findings of these studies support the causal influence of how adults represent their children and themselves as parents.

The AAI does not measure child-oriented mentalization, but a mentalization capacity is associated with the development of a secure, autonomous state of mind in adults by enabling them to reflect on the intentions and motives of their own parents, as well as themselves (Steele & Steele, 2008). One study found that when the Adult Attachment Interview was administered prenatally, the attachment states of mind of the parents-to-be predicted the attachment security of their children at age one (Steele et al., 1996). The association was strong: 76% of the infants were securely- or insecurely-attached in a manner that was concordant with maternal AAI status as autonomous or nonautonomous. When the different insecure groups were distinguished for both infants and mothers, 64% of the infants had an attachment classification that exactly matched the mother's attachment state of mind (e.g., infant avoidance with maternal dismissing). When father-infant attachments were assessed, the concordance between paternal AAI and infant-father attachment security was comparably strong. Taken together, these findings contribute further support to the view that parent attachment representations causally influence the parental care that leads to infant security.

In a meta-analysis of this literature, van IJzendoorn (1995) compiled the results of 18 studies involving assessments of parental AAI and infant security of attachment. Consistent with the foregoing, the concordance between parents and infants in their security vs. insecurity was 70%, and 63% of the infants had an attachment classification that exactly matched the parent's attachment status. Furthermore, in this research compendium there were 10 studies that included measures of parental responsiveness. The meta-analysis of the association between parents' attachment representations and parental responsiveness also yielded a strong association, with an effect size of 0.72 (comparable to a correlation of $r = 0.34$).

Based on these and other findings, van IJzendoorn noted that the direct association of adult attachment with infant attachment was substantially greater than when their association was mediated by parental responsiveness. This is consistent with other findings reviewed in this chapter: the association of parental sensitivity with infant security of attachment is moderate, for example, while the association of adult attachment with infant security is substantial. Adult attachment also predicts parental sensitivity, but these findings highlight that an adult's attachment representations seem to influence the development of attachment security through avenues other than the sensitivity of parental care. Van

IJzendoorn (1995) called this the "transmission gap."

Over the years, the transmission gap has inspired considerable discussion among attachment researchers as well as substantial research. Much research has focused, for example, on the genetic correlates of individual differences in infant attachment because parents and infants share, of course, around 50% of their genes. This work has increased in volume as longstanding methods in behavioral genetics have been supplemented by the more incisive methods of molecular genetics, which permit the identification of specific gene alleles and their behavioral correlates. In general, the conclusions of twin studies, analyses of genetic polymorphisms, and gene x environment interaction studies converge on the conclusion, consistent with attachment theory, that differences in the security of attachment are primarily a result of environmental experiences, and very little evidence supports a genetic basis (see an excellent summary of this research by Fearon et al., 2016). In short, the transmission gap cannot be attributed to the shared heredity of parents and children.

Other potential explanations for the transmission gap have been suggested earlier. Because adults' states of mind concerning attachment in the AAI are associated with marital quality (Crowell et al., 2016), this might be one avenue by which adult attachment influences the security of offspring beyond parental sensitivity. In other words, an adult's attachment representations influence the quality of the marital relationship which, in turn, affects the security that infants derive from their parents (recall the Emotional Security Theory discussed above). It is also likely, at least in some cultural contexts, that parents' states of mind affect other aspects of parent-child interaction, such as the adult's warmth, dyadic synchrony, and playfulness that influence the security of attachment somewhat independently of parental sensitivity. Finally, it is important to note that subsequent research since van IJzendoorn's, 1995 review has narrowed the transmission gap, owing in part to the lower concordance of adult attachment with infant attachment security and its diminished association with parental sensitivity in more recent studies (Verhage et al., 2016). The concordance between parents and infants in their security vs. insecurity is now estimated at 66%, and approximately 51% of infants have an attachment classification that exactly matches the parent's attachment status. This remains a significant association but leaves a somewhat smaller gap in the variance explained in infant attachment beyond parental sensitivity.

Considered together, these findings have enhanced theoretical appreciation of the intergenerational influences contributing to the development of a secure or insecure attachment. These influences are founded on the sensitive care that shapes an attachment relationship with young children. Underlying sensitivity is the adult's mentalization capacity that supports parental responsiveness and influences other features of parent-child and family interaction. These processes affect the growth of secure or insecure attachments and the mental working models of self and relationships that are developing in young children. Attachment theorists believe, therefore, that a developmental association exists between the attachment representations of parent and offspring, mediated by multiple aspects of their developing relationship. This association is important because a young child's developing capacity for mentalization -- that is, the capacity to reflect constructively on another's internal states as well as one's own -- is based, in part, on the parent's enlistment of this capacity in their responsiveness to the child (Fonagy & Target, 2002). Seeing one's feelings and intentions recognized and valued by an attachment figure enables young children to appreciate others' feelings, intentions, and other mental states, as well as one's own. This may be one reason for the concordance of the parent's attachment state of mind with the child's attachment security.

Attachment as a Relational Construct

Although it is common to refer to infants and young children as securely or insecurely attached children, as in this chapter, this is a conceptual shorthand that may at times be misleading. When

describing young children in this manner, researchers are typically referring to the quality of attachment shared by the child with a primary caregiver, usually the mother. But attachment researchers have long known that children share different qualities of attachment with different caregivers: they can be secure with their mothers, insecure with their fathers, insecure with a child-care provider, and perhaps secure with a grandparent who provides regular care (Fearon & Schuengel, 2021). It may be true that one of the reasons that the security of attachment assessed with a single caregiver explains only a moderate proportion of variance in outcomes like social competence and emotional adjustment is that these characteristics are also shaped by other influences, including the quality of attachment with others.

Especially when infants and young children are concerned, it is important to regard attachment as a relational construct, not solely an attribute of a young child (Sroufe, 2021). The centrality of early relationships is part of the meaning of Donald Winnicott's (1957) famous aphorism, "[t]here is no such thing as a baby . . . you are describing a baby and someone." This view is underscored by the research discussed above concerning the network of representational and relational processes contributing to the intergenerational transmission of attachment between parent and child. It is also underscored by studies, also described above, documenting the importance of relational experience in the early years not only to the formation of attachment but also to its stability over time and the child's developing characteristics and skills, such as emotional health and self-regulation, with which a secure or insecure attachment is associated.

The idea of attachment as a relational construct also extends to understanding disruptions and disorders related to attachment. Viewed in this light, attachment disorders are not just problems of the individual child, but of a disordered relationship. This view is reflected in the most recent edition of the *Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood (DC:0–5)* (Zero to Three, 2016) in at least two ways.

First, this diagnostic manual proposes a new clinical (Axis I) category of "Relationship Specific Disorder of Infancy / Early Childhood" defined by symptomatic behavior (e.g., fearfulness, aggression, oppositional behavior, sleep refusal) that appears in only one relational context and not in others. In these circumstances, an attachment relationship exists between the child and caregiver, but it is disturbed, and this disturbance does not extend to the child's relationships with other attachment figures. To be sure, a disturbance in the child's relationship with a primary caregiver can have broader consequences for how the child behaves and relates to others, but the primary disturbance arises from dysfunction in a specific relationship.

Second, the diagnostic manual proposes a second Axis II assessment of the "relational context" of the child involving the clinician's appraisal of multiple aspects of the relationships the child shares with caregivers. In doing so, the diagnostic instructions state that "[t]here is no presumption that the relationship quality between an infant/young child and one primary caregiver is related to the relationship quality between an infant/young child and other primary caregivers" (Zero to Three, p. 141). Both of these proposals are based on the recognition that especially with young children, while there can be behavioral problems that generalize to multiple contexts and people, often the problems and adaptations characteristic of one adult-child relationship do not generalize to others.

Taken together, the approach to early mental health based on this view of attachment as a relational construct means that clinical attention to both the child and a specific adult is important. Indeed, in most cases, the adult will be a primary focus of therapeutic attention, especially when infants and toddlers are concerned, because of the adult's greater capacity to respond constructively to clinical assistance and the young child's adaptability to more supportive relational interaction. Examples of therapeutic approaches of this kind follow later in this chapter.

Relationships Influence Other Relationships

Understanding attachment as a relational construct highlights that each attachment relationship between a child and caregiver incorporates unique influences from each partner. Furthermore, children are also embedded in an environment of relationships, some of which are attachment relationships, and these relationships are mutually influential. As earlier noted, young children can have secure or insecure attachments with their mothers, fathers, and other caregivers, and these relationships have overlapping as well as distinct influences on children's development (Fearon & Schuengel, 2021). In addition, these caregivers have relationships with each other that influence how they interact with the child, such as how the support of mothers or a grandparent can facilitate fathers' involvement with their infants (see Chap. 20 by Hennigar and Cabrera, this volume). Viewed in this light, attachment theorists are increasingly thinking of the attachment *networks* that influence early development (Dagan & Sagi-Schwartz, 2022).

Attachment researchers are beginning to empirically model these networks and their developmental influence. One approach is to profile the secure and insecure attachments of children within their families and examine whether their combined effects are additive (more secure attachments yield better developmental outcomes), buffering (a secure attachment to one parent compensates for insecurity with the other), hierarchical (a secure attachment to one parent is more influential than security with the other), or horizontal (secure attachments to each parent have comparable effects on the child) (Dagan & Sagi-Schwartz, 2022). This strategy can help characterize the relational resources of the child in the family environment. Another approach is to recognize that relationships differ qualitatively from each other, so father-child attachments might have different domain-specific influences (such as on developing emotion regulation, owing to fathers' emotionally arousing play) compared to mother-child attachments (Thompson, 2022). This approach expands in interesting ways when attachments to childcare providers are also considered when their influences on young children's peer relationships and behavioral adjustment might be more prominent (Ahnert, 2021). These domain-specific influences are also likely to color the security they afford, the mental representations they inspire, and the influence of these relationships on different aspects of young children's development.

Attachment researchers recognize, of course, that the impact of relationships on other relationships occurs not only through behavioral influences but also representationally from the effects of models of past relationships on current interactions. Most people experience this intuitively when they find themselves responding to a romantic partner on the basis of a past relationship, or responding to their children from memories of how their parents responded to them as children. This is part of the genius of Bowlby's concept of internal working models of relationships. The recognition that a parent's responsiveness to the child is based, in part, on the mental models they bring to their interaction with the child is clinically valuable because when an adult's past includes relationships that have been traumatic or frightening, their representations of those relationships can remain influential long after they were harmed and influence the parent's relationship with a child who did not exist when they occurred. These mental representations constitute, in the words of a classic analysis, the "ghosts in the nursery" (Fraiberg et al., 1975) that, in situations requiring therapeutic intervention, have undermined a parent's capacity to provide appropriate care to a young child. Therapeutic intervention, from an attachment perspective, requires not only unlearning dysfunctional patterns of interaction with the child or acquiring new skills of emotional coping but also attention to the mental models of relationships and the nature of past relationships that pose obstacles to effective parenting. Fortunately, in attachment-based adult psychotherapy, the clinician also provides another relationship that can contribute to revising mental working models through therapy. Several of the therapeutic

approaches described below incorporate this understanding.

In other situations, it is instead the young child's relational history and the working models it inspires that create obstacles to new attachments and more serious psychological problems. One example is *reactive attachment disorder* (RAD), defined by a child's difficulties in developing meaningful relationships with primary caregivers, and which is typically attributed to markedly inadequate prior care, such as in institutional placement, repeated changes in foster care, maltreatment, or other forms of neglect or deprivation (American Psychiatric Association, 2013; Zeanah & Smyke, 2009). RAD is typically manifested as emotionally withdrawn or inhibited behavior involving minimal responsiveness to an adult's caregiving initiatives, limited positive affect, and episodes of sadness or fearfulness even in non-threatening circumstances. In the past, there was a second form of RAD that is now separately diagnosed as Disinhibited Social Engagement Disorder (DSED) and consists of a failure to show developmentally appropriate wariness of unfamiliar adults and a preference for familiar caregivers. A diagnosis of RAD or DSED is typically made before the age of 5, and the prevalence of each is very low. Treatment focuses on efforts to help the child feel safe with a reliable, emotionally available caregiver and the promotion of a responsive, secure relationship with that person. This may require therapeutic efforts to strengthen the sensitivity of the caregiver, even if the adult (such as a foster parent) was not involved in the circumstances leading to the child's current problems.

RAD and DSED each show how a young child's relational past can impede forming new attachment relationships, and illustrate the importance of a young child's developmental history (most notably when institutional or foster care is involved) in the development of attachment. As stated earlier, a young child's current adaptation is a function both of current experience and developmental history. As with adults, therefore, the therapeutic goal is not just behavioral change, but a representational adjustment to new conditions of care and the development of new relational expectations. Not surprisingly, assessing therapeutic outcomes is more challenging with young children than with adults because changes in internal working models have to be evaluated indirectly, often through change in attachment security, as well as in the improved responsiveness of children to their new caregivers.

Implications for Preventive and Therapeutic Interventions

An attachment approach to early childhood mental health emphasizes several important ideas. When infants and young children are concerned, relationships are fundamental to emotional well-being or, conversely, psychological vulnerability. Different qualities of attachment confer different strengths and vulnerabilities to child development and the growth of new relationships, in part because of the cascading developmental processes they promote. How early relationships are influential is not only in the security they afford but in the adult characteristics contributing to security, such as sensitivity, insightfulness, and a capacity for mentalization (manifested in reflective functioning), that constitute some of the "active ingredients" for the development of attachment. These characteristics are important because they are based on the adult's mental working models of relationships derived from their own attachment history, and because they influence parenting behavior as well as the child's mental representations of relationships and the self. Those mental representations – in the adult as well as the child – can be a primary focus of therapeutic intervention, and the challenge of attachment-informed therapy is how to alter the legacy of past relationships through new relationships and the representations they inspire.

Contributing complexity but also opportunity to attachment-informed treatment is the recognition that a child's psychological difficulties may be relationship-specific and that young children are embedded in attachment networks involving influences from other attachment figures (some of whom can potentially offer support to the child). In part owing to these attachment

networks, young children's security is affected by a variety of influences, including the quality of the marital relationship and the family's economic stresses, as well as the child's history of prior care and the contexts in which this occurred. The influence of the security of attachment extends to many features of a young child's developing capabilities and characteristics, which makes attention to early difficulties important to long-term well-being. However, the security of attachment can change, offering hope for improvement in a young child's functioning when relationships improve. Finally, attachment researchers have become more sensitive to cultural diversity in parenting practices that support attachment in recent years, which extends to preventive and therapeutic contexts where diversity in how parents can support young children is recognized.

Attachment-informed therapeutic approaches to early childhood mental health problems incorporate many of these ideas in various ways. In this section, some of the leading approaches are summarized to illustrate how this is so.

Child-Parent Psychotherapy

Child-parent psychotherapy (CPP) was developed to address the challenges of infants and toddlers with mental health disturbances owing to trauma or other attachment-related problems (Toth et al., 2018; see Chapter 19 by Ghosh-Ippen and Lieberman in Vol. 2 of this Handbook). It is based on the model of infant-parent psychotherapy pioneered by Fraiberg et al. (1975) discussed above. The goals of CPP are to address parents' prior experiences of trauma and their current triggers in order to strengthen sensitivity to children's needs and improve child outcomes. A major focus is changing the maladaptive representations that the parent and child have developed toward each other. This is advanced by facilitating positive interactions between the parent and child through which therapists speak for the child's emotional needs, model appropriate behavior, supportively explore the parent's troubled interpretations of the child's behavior, and provide developmental guidance. It is typically implemented in weekly sessions over 10–12 months that can occur in an office or home setting. In this process, the therapist's emotionally supportive relationship with the parent is central to therapeutic change, with the focus on strengthening the parent-child relationship, and an expectation that improved parental functioning will be manifested in increased secure attachment and other positive outcomes in children over time.

Several randomized controlled trials (RCTs) have documented these outcomes. In an early study, one-year-old infants from maltreating families were randomly assigned to child-parent psychotherapy and three other groups, and a nonmaltreatment comparison group was also included (Cicchetti et al., 2006). Mothers in the maltreatment groups reported greater abuse and neglect in their own past, more insecure relationships with their mothers, more parenting stress, and lower family support, and they showed less sensitivity to their infants compared with nonmaltreating mothers. Their infants showed significantly higher rates of disorganized attachment compared to those in the nonmaltreatment group. At follow-up after a year of therapeutic intervention when infants were 26 months, children in the infant-parent psychotherapy group and one other group showed significant increases in secure attachment, while this was not true of children in the other groups. Furthermore, mothers in the CPP group showed a significant increase on a measure of reflective functioning from pre- to post-intervention on the AAI, although there was no indication that this change mediated changes in parental behavior leading to child attachment (Toth et al., 2008).

In an independent sample, narrative story-stem assessments were used to appraise changes in the mental representations of self and relationships of maltreated preschool children following a year of child-parent psychotherapy compared to a nonmaltreated comparison group (Toth et al., 2002). At age 5, children who had participated in child-parent psychotherapy showed a significant decline in maladaptive maternal representations based on story-completion responses, a decrease

in negative self-representations, and a significant improvement in mother-child relationship expectations. Taken together, child-parent psychotherapy, as it has been applied to disordered parent-infant and parent-preschooler relationships, has been shown to improve both direct and indirect measures of children's attachment and relationship representations, presumably through improvements in parental sensitivity, although parental behavior (the crucial mediating variable) has not been measured in these studies.

Attachment and Biobehavioral Catch-Up

The attachment and biobehavioral catch-up (ABC) approach was originally designed for foster parents because of their difficulties in caring for infants whose rejecting behavior reflected their past adverse experiences with caregivers. Later the intervention was extended to high-risk biological parents and other parent groups (Dozier & Bernard, 2019). The goals of ABC are to strengthen parental nurturance and other practices that contribute to young children feeling safe and developing secure attachments. These practices include encouraging parents to provide nurturance even when children do not elicit it (and who may push the adult away) and even if it does not come naturally; following the child's lead in interaction; and providing consistently nonfrightening care. These and related goals (such as helping parents recognize voices from their own past) form the themes for 10 weekly sessions that involve several elements, including direct guidance from parent coaches, viewing video examples of other young children and parents, helping parents implement the target practices in interaction with their own children (and coaches offering frequent "in the moment" comments to support these behaviors), and viewing videos of past sessions with parent and child that coaches have filmed to provide further examples of target practices and offer positive reinforcement.

Several RCTs of the ABC approach have documented improvements for children and their caregivers. In one study, infants and toddlers whose parents had been referred to Child Protective Services for neglect were assigned either to the ABC treatment or to a control condition involving developmental education. After the program, children in the ABC group showed significantly lower rates of disorganized attachment and higher rates of secure attachment compared to control group children (Bernard et al., 2012). Children in the ABC group also showed more normalized physiological stress reactivity several months after the intervention, and this was maintained into the preschool years (Bernard et al., 2015). Several years after the intervention, mothers who had participated in the ABC treatment showed greater attachment security (through an attachment script knowledge assessment) compared to mothers in the control condition, and there was evidence that this enhanced attachment security contributed to observations of improved parental sensitivity to the child at follow-up (Raby et al., 2021). In a separate study, foster mothers of children under age 2 who participated in the ABC treatment showed greater increases in sensitive responsiveness during a 10-minute play session compared to mothers in a developmental education control group (Bick & Dozier, 2013). In sum, follow-up assessments have demonstrated improvements in children's attachment security and physiological regulation, parental sensitivity, and parents' attachment representations, with even some preliminary indications that representations mediated parental sensitivity in theoretically expected ways.

Attachment-Based Programs with Video Feedback

The ABC treatment uses video feedback as part of its intervention. Several other attachment-informed therapeutic programs for children from birth through age five also enlist video feedback procedures to help parents take perspective on their interactions with their children and their children's responses to them. The Video-Feedback Intervention to Promote Positive Parenting and Sensitive Discipline (VIPP-SD) is

designed to enhance sensitive parenting and promote adequate discipline strategies by parents over the course of six sessions at home (Juffer et al., 2018). The Attachment Video-Feedback Intervention Program (AVI) seeks to accomplish a somewhat broader range of goals over eight weekly sessions, including the development of interactive synchrony between parent and child, shared positive affect, helping parents better interpret and respond to the child's signals and emotions, and helping parents reflect on their interactive difficulties with the child and find solutions (Moss et al., 2018).

In addition to the intervenor's guidance and instruction, a central component of each program is the use of videotaped interactions between parent and child, which are recorded in the previous session and edited with written commentary by the intervenor in VIPP-SD, and are recorded earlier in the same session in AVI. In each case, the video segments provide opportunities for the intervenor to affirm positive elements of parent-child interaction, occasionally stopping the video briefly to ask parents how they might have responded differently when interaction did not go well, provide interpretive comments about child behavior and motivations, and use the segment to discuss issues related to the therapeutic goals. For parents, watching themselves with their child permits greater reflection on how and why they acted as they did, as well as how and why the child responded, and so provides a forum for the reflective capacity that is an important element of mentalization in parent-child interaction.

Although there are other attachment-informed programs that also incorporate video feedback procedures, VIPP-SD and AVI are distinctive for the number of RCT evaluations confirming their benefits for parents and young children. Across 12 randomized controlled trials, VIPP-SD has been shown to significantly enhance parental sensitivity, with effect sizes across these studies indicating a strong impact. There is also some evidence of increased attachment security and reduced behavior problems in children (see review by Juffer et al., 2018). AVI has also been shown to increase sensitive parenting and attachment security, as well as to reduce the incidence of disorganized attachment (Moss et al., 2018). Together, these and related interventions demonstrate a creative avenue to promoting sensitive parenting by increasing the opportunities for parents to reflect thoughtfully, and with guidance, on their own behavior and that of their children. Compared to the other approaches, however, programs enlisting video feedback procedures do not devote considerable attention to parents' representations of their past relationships or their current representations of the child.

There are other noteworthy attachment-informed therapeutic approaches to early childhood mental health problems, including the Circle of Security (see Chapter 25 by Poulsen, Quinlan, & Boris, Vol. 2), Minding the Baby, and the Group Attachment-Based Intervention (see Steele & Steele, 2018, for thoughtful chapters on these and other attachment-informed interventions). The results of a meta-analysis of the programs that existed in 2003 confirmed that they had a significant influence on improving parental sensitivity and increasing secure attachment, with a somewhat greater impact on the former since parents were the target. Interventions that were more effective in enhancing sensitivity were also more effective in increasing attachment security (Bakermans-Kranenburg et al., 2003). Interestingly, the meta-analytic findings also suggested that longer program duration did not necessarily result in greater therapeutic success (accounting for the title of the review, "less is more"), although it is unclear whether this conclusion would be confirmed 20 years later.

There are also well-designed attachment-informed prevention programs, such as through home visitation (Berlin et al., 2018) and child care (Owen & Frosch, 2021). In child welfare, the Safe Babies Court Teams approach incorporates ideas from attachment theory into the collaborative treatment planning for maltreated infants and toddlers appearing before family court that includes judges, lawyers, early childhood mental health experts, child welfare agency authorities, and others relevant to the needs of individual families (Osofsky & Lieberman, 2011;

see https://www.zerotothree.org/our-work/itcp/the-safe-babies-court-team-approach/). An important part of the program is the education of the adults about the effects of trauma on young children, the significance of attachment relationships, and the developmental needs of young children. This program instantiates the idea that in addition to a child's attachment figures there is a broader environment of relationships that can be called upon for help and support.

The brief descriptions of these programs do not readily capture the richness of the intervention or preventive efforts they represent, but they are meant primarily to foreground the ideas of attachment theory that are at their core. These include strengthening parental sensitivity as a central goal because of its benefits for improving the child's attachment security, attention to adult attachment representations as well as those of the child, enlisting the relationship with the therapist as an avenue of support, and growth in the parent's mentalization, especially in relation to their child. The challenge for the next generation of studies in this area is to move beyond documentation of the effects of these programs and to begin testing the mediational models between mental representations, parental behavior, and child attachment security that are at the heart of these approaches to attachment-informed therapy (Dozier & Bernard, 2021).

Summary and Key Points

What distinguishes an attachment-informed approach to infant and early childhood mental health? First, an emphasis on the mental representations that underlie the behaviors and emotions that characterize the interactions between parents and young children. Second, respect for the intergenerational influences by which the attachment history of the parent can influence the developing attachment of the child through the sensitivity of parental care, the parent's mentalization capacity, the broader family context of their relationship, and influences from the social and economic context. Third, an awareness of how different qualities of attachment come with specific strengths and vulnerabilities in how relationships are understood, how current relationships are engaged, and the potential for constructive future relationships. Finally, early attachments inaugurate developmental trajectories in social and personality development that are significant but not immutable, and this provides opportunities for developmental remediation through two-generation interventions that target both parent and child simultaneously.

Taken together, one of the central ideas that unites attachment theory with early childhood mental health is the universal need for social support. In infancy and early childhood, this is demonstrated in the formative influence of secure or insecure attachments, and the cascading problems of psychological adaptation that can occur when support is lacking or unreliable. The attachment literature aptly demonstrates the importance of secure attachments, and the social support they afford, throughout the life course. Likewise, research in developmental psychopathology shows how significantly social support enhances psychological well-being throughout life, beginning in infancy (Thompson, 1995).

One of the more encouraging messages from the research reviewed in this chapter is that when circumstances undermine access to social support for infants and young children or their caregivers (or both), evidence-based attachment-informed programs have had demonstrated success in restoring supportive parenting, strengthening secure attachments in children, and enabling parents and children both to move ahead with a more constructive understanding of early relationships. Building on this remarkable accomplishment through more incisive research inquiry into the avenues by which early insecure attachment is changed is a worthwhile goal for the next generation of research on attachment and early childhood mental health.

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17 Intervening with Fathers and Their Children from the Perspective of the Activation Relationship

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To this day, parent-child intervention has been guided by attachment theory, addressing issues of sensitivity and parenting competence from the standpoint of the mother-child relationship. A few decades ago, the mother's role was considered to be biological, fulfilling essential functions for the survival of children, and the father's role, at best cultural, plays a variable part in socialization according to the culture. Inspired by the evolutionary perspective, Bowlby (1969) developed the attachment theory in order to better understand the pathogenic effects on children's mental health of a lack of maternal care due to early and prolonged separation. Today, it has become necessary to develop a theory emphasizing the biological and therefore universal parental functions of the father in order to guide interventions for children's mental health problems, particularly in increasingly complex physical and competitive social environments, at least in Western industrialized societies (Paquette, 2005). Evolutionary perspectives are the best approach for explaining the universals of the human species (Tooby & Cosmides, 1990). This chapter presents the emergence and development of the activation relationship theory, a theory rooted in evolutionary perspectives just like attachment theory, before examining an early childhood intervention program involving father-child dyads. The evolutionary perspectives can help psychiatry to better understand psychopathology and therefore to better intervene with people with mental health issues.

Evolutionary Psychopathology

Evolutionary psychopathology (Darwinian psychiatry) is a sub-discipline of Darwinian medicine that aims to better understand the symptoms of mental illness in light of natural selection. This discipline is concerned with ultimate "why questions", seeking to explain the proximate mechanisms behind the "how" and "what" of mental health problems by also taking into account cultural evolution (McGuire & Troisi, 1998; Plusquellec & Paquette, 2016; Stevens & Price, 2000). It considers the possibility that mental health problems have adaptive functions for survival and reproduction, independent of the suffering experienced by individuals. At least three ultimate reasons can be put forward in this regard (Workman & Reader, 2014). Firstly, the pleiotropy argument suggests that genes that predispose individuals to mental illness may also have inclusive fitness benefits. Inclusive fitness is the total reproductive success of an individual, i.e.,

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the transmission of copies of its genes to the next generation, including the genes of its own offspring as well as of its relatives' offspring. Secondly, according to the trait variation argument, maladjusted individuals are those at the extreme ends of the normal distribution curve (for example anxiety and aggression). Thirdly, according to the time-lag argument (mismatch hypothesis), some traits are maladaptive in today's environment (which has changed considerably in a short period) whereas they were adaptive in the ancestral environment of hunter-gatherers (maybe unipolar disorder and food disorders). For example, according to the social competition hypothesis (Price et al., 1994), depression is due to a fall in status or inability to rise in social hierarchy, which would have the advantage of ending the conflict and allowing reconciliation, while also avoiding physical health problems resulting from high chronic stress hormones.

Sex differences, when universal, may be the result of biological evolution (particularly through the mechanism of sexual selection), and are usually amplified or diminished by cultural evolution. Numerous studies have shown that women tend to have more internalizing problems (eating disorders, anxiety disorders, depression), and men, more externalizing problems (substance use disorders including alcohol, ADHD, conduct disorder, antisociality) (Arnett et al., 2015; Dattani et al., 2021; Smaragdi et al., 2020).

As both the origins of psychopathology and its distribution across sexes appear to be rooted in evolution, it becomes important to understand the specific mechanisms by which mothers and fathers contribute to the development or prevention of psychopathology,

Overall, in addition to its biological basis, psychopathology is also related to early experience. While research has documented the impact of the mother-child relationship on later psychosocial adaptation, there seems to be a gap in both knowledge and theory about the specific input of the father-child relationship on later psychosocial adjustment, and about how to intervene early to foster a healthy father-child bond.

The Activation Relationship

The activation relationship theory originated in 2004 from three observations. First, in the Western industrialized societies of today, mothers are more involved than fathers in all dimensions of parenting except physical play. Given that child still develop an attachment to their fathers, Lamb et al. (1985) suggested that physical father-child play contributes to the development of children's attachment to their fathers. Research over the last years has confirmed that fathers engage in vigorous physical contact play more frequently than mothers do, especially rough-and-tumble play (Flanders et al., 2009; Fliek et al., 2015; Gomes, 2015; Majdandzic et al., 2016). Second, Le Camus (2000) proposed the existence of a function of opening to the world to explain fathers' tendency to prompt children to take initiative in unfamiliar situations, to explore, to take chances, to overcome obstacles, to be braver in the presence of strangers, to stand up for themselves, and to discipline children. Third, the observational method for assessing attachment quality in infants, the Strange Situation Procedure (SSP; Ainsworth et al., 1978), which was validated with mothers, has yielded results that were weak or at odds with what was expected when used with father-child dyads.

Paquette (2004a, 2004b) defined the activation relationship as the child's emotional bond to a parent that fosters the opening to the world, with a special focus on parental stimulation and control during the child's exploration. Given that fathers seemed to be particularly involved in developing their children's opening to the world, the emphasis was at first placed solely on the father-child activation relationship. The activation relationship theory considers risk-taking to be a basic need that enables children to develop their motor and competitive skills, explore their physical and social environments, and adapt as needed, and fathers may play a major role in helping their children, especially boys, to learn to control their risk-taking behaviors. Indeed, men have a universal tendency to take more psychological and physical risks on average than women

in all spheres of daily life (Baker & Maner, 2008; Byrnes et al., 1999; Farthing, 2007; Pawlowski et al., 2008). Men's greater risk-taking is the result of sexual selection, whether reinforced by the current ideological and social context of the culture at hand. Sexual selection (Darwin, 1871) is a process of natural selection that is explained by the fact that females have, from generation to generation, chosen to breed with males having traits that can provide their offspring with better survival genes (Workman & Reader, 2014). An example is mating with males who take more risks in their intra-sexual competition for sexual partners and become dominant. In humans, male risk-taking in foraging has likely also played a role since the emergence of the hunter-gatherer societies leading to the sexual division of labor, so that males would be family providers in a context where young children require an extensive amount of maternal care because of their developing brains and vulnerable bodies (Möller et al., 2013; Paquette, 2004a).

Paquette et al. (2020) reintegrated mothers into the activation relationship theory by explaining that it is possible that in our primate ancestors, mothers assumed both attachment and activation functions with their offspring, and the emergence of the hunter-gatherer lifestyle led to differentiated maternal and paternal functions. So, maternal and paternal functions are here seen as complementary, whether the couple is composed of same- or different-sex parents. Although children develop both types of relationships with each parent women will tend to act as the primary attachment figure (performing maternal functions), while men will tend to serve as the primary activation figure (performing paternal functions). It may be hypothesized that these complementary functions also exist in homosexual couples for the same reason, that is, to be able to optimally meet the child's many needs (Paquette et al., 2020).

Although Feldman and Shaw (2021) recently concluded the existence of a new caregiving construct, the activation parenting, it is important to understand the difference between parenting behavior and the parent-child relationship. Parenting behavior is a characteristic of the parent whose frequency and quality are not necessarily associated with child well-being: a parent's identical behavior toward two children within the same family may have different developmental consequences. The parent-child relationship is a dyadic measure arising from the dynamic transactional interaction between parent and child characteristics in a particular context. According to the organismic model (compared to the mechanistic model; Lerner, 2002), for which the levels of organization are qualitatively different (i.e. governed by different laws), the parent-child relationship constitutes a higher level of organization that is greater than the sum of its parts. In the case of the activation relationship, the child's feeling of confidence results from the child's characteristics (sex, temperament, etc.) and the parent's encouragement of risk-taking during the child's exploration of his/her environment, with the parent protecting the child through discipline or limit-setting (Paquette & Bigras, 2010).

The Risky Situation (RS) is a standardized observational procedure designed to assess the quality of the parent-child activation relationship in children aged 12–24 months (Paquette & Bigras, 2010) and in children 2–5 years old (Gaumon & Paquette, 2013). This procedure was developed based on Ainsworth et al.'s (1978) brilliant idea to assess the quality of the attachment relationship with the SSP. In the SSP, specific instructions are given to the parent to control parental behavior. In particular, the parent is instructed not to interact with the child. This instruction destabilizes the child's interaction pattern and activates the attachment system, highlighting the differences between children in the quality of their attachment relationship with their parents. The coding of child behaviors in this context provides a dyadic measure of the relationship, not a measure of the child's characteristics, and is not as sensitive to the current context as a free activity would be. In the RS, the dyads are placed in an unknown room and the children are exposed to a social-risk situation (i.e., a stranger gradually interacting more and more intrusively with the child) and a physical-risk situation (i.e., stairs), and finally a parental prohibition to go on the stairs. The parent is asked

to interact with their child only to ensure their safety or to comfort them if necessary. As is the case with attachment assessed with the SSP, controlling the parent's behavior with specific instructions during the RS prompts reactions in the child that highlight their relationship with their parent, i.e., that reflect the interactive history between them. The RS reveals the balance between exploration and the acceptance by the child of limits imposed by the significant parent, while the SSP sheds light on the balance between exploration of the environment and seeking comfort from the significant parent. The parent-child activation relationship is thought to serve as a proximate mechanism by which biologically predisposed risk-taking differences in children may diminish or increase according to the current environment (Paquette et al., 2020). Children with an activated relationship with a parent are confident and prudent in their exploration and obey when the parent sets a limit. On the contrary, children with an underactivated relationship to a parent tend to engage in little exploration, be passive and withdraw from novelty, or stay close to the parent. Finally, children with an overactivated relationship with a parent are reckless and non-compliant when the parent sets limits, therefore leading children to have more accidents because of a lack of prudence. Underactivation is related to parental overprotection, while overactivation is to a lack of parental discipline. The coding grid also provides three scores between 0 to 5: an underactivation score, an overactivation score, and an activation score. A high activation score indicates that the child is optimally activated by the parent and that the underactivation and overactivation scores are low.

The activation relationship theory is rooted in the evolutionary perspectives, particularly in the life history theory (Aimé et al., 2018; Paquette, 2015; Roff, 1992). According to this theory, every living organism must allocate the global energy potential available during its existence between the three main vital functions of integrity (for example via the immune system), growth (including skill acquisition), and reproduction (including competition for sexual partners and parental investment). Given the limited nature of the available energy potential, trade-offs must be made between these three functions, with one or the other being favored depending on environmental characteristics (Aimé et al., 2016; Kaplan & Gangestad, 2005; Roff, 2002). These trade-offs constitute different types of "life-history strategies" that play out unconsciously through individual preferences and behaviors (Kenrick et al., 2010). Regarding reproductive function, different possible strategies are distinguished along a gradient from slow to fast (Promislow & Harvey, 1990). In humans, a fast strategy will be characterized by early romantic and sexual relationships and more partners, accelerated pubertal development, and more offspring, but limited parental investment. This is referred to as a quantitative strategy, which tends to favor the transmission of genetic heritage in the short term, i.e., by increasing the number of descendants (Ellis, 2004; Griskevicius et al., 2011; Simpson & Belsky, 2008). A slow strategy, on the other hand, will be characterized by a later onset of romantic and sexual relationships, fewer but more stable relationships over time, and fewer offspring but greater parental investment. This type of strategy, known as qualitative, favors the condition of the offspring, i.e., their own likelihood of reaching reproductive age and reproducing in turn. Indeed, parental investment increases both the children's odds of survival by providing them with the resources necessary to meet basic needs (food, protection, etc.) and their likelihood of developing a strong social network, acquiring a higher socioeconomic status, and finding a partner (through education and the learning of various skills, especially social skills). Such a strategy based on parental investment can therefore maximize the transmission of the individual's genes over the long term, generation after generation (Chisholm & Burbank, 2001). Several studies have shown that different reproductive strategies are often associated with specific social behavioral traits. In particular, a quantitative strategy is often correlated with an increased tendency to take risks, more aggression, and involvement in conflict or even illegal activities (Belsky et al., 2010; Figueredo et al., 2006; Griskevicius et al., 2011).

A child's overactivation would be adaptive in a setting fraught with competition over immediate access to unpredictable resources; the child is then inclined to take greater risks to capture as many resources as possible in the short term (Paquette et al., 2020). Overactivated children will generally tend to use aggression and other antisocial behaviors regardless of the context and to strive for high social dominance status in order to maximize immediate access to resources. This profile may be expected to develop mainly in boys living in situations of poverty, when the parent prefers to have a high number of children, to the detriment of their parental involvement with each child. This reproductive strategy is referred to as "quantitative" since it involves having as many children as possible as early as possible (early reproduction). In contrast, the activated profile is adaptive in the context of sufficient and stable resources (Paquette et al., 2020). The child thus develops cooperation skills and establishes a stable network of friends that will procure him or her more resources in the long term. The child is therefore able to take calculated risks. Activated children will have a varied repertoire of behaviors to cope with diverse competitive situations: they may be expected to use assertiveness, and, if necessary, aggression in confrontational contexts with threatening children, but prefer to use cooperation whenever possible. Their prosocial abilities may enable them to achieve leadership. This reproductive strategy is known as "qualitative" since it consists of effectively preparing the individual for later reproduction. Child underactivation would be adaptive in a dangerous social or physical environment (Paquette et al., 2020). This danger can be real or merely perceived by the parents. The underactivated profile could result from parent overprotection, for example, due to the interaction between the lower number of children per family in Western societies today and the overrepresentation of various dangers in the media. This profile may be expected to develop mainly in girls to avoid injury, given that their reproductive success depends solely on their future ability to bear children (Paquette, 2015). Underactivated children will tend to be anxious, to avoid conflicts, submit to others, and leave resources to those who demand them.

The activation relationship theory predicts that fathers activate children more than mothers do, that boys are more activated by both parents than girls are, that the activation relationship is associated with risk-taking and competition for resources, that overactivated children on average engage in more aggression than those in the other two profiles, and that underactivated children on average are more anxious than activated and overactivated children. Paquette and Bigras (2010) hypothesized an association with externalizing behaviors because they considered these behaviors to be risk-taking in nature. Indeed, three quarters of the CBCL externalizing behaviors scale items (Achenbach & Rescorla, 2000) describe aggressive behaviors. Aggression constitutes both risk-taking and a way of competing for environmental resources and social rank (Paquette, 2015). Vaughn et al. (2003) showed that prosocial children use aggression instrumentally (proactively); in other words, they will choose aggression or prosocial strategies depending on the context, whereas for their less socially competent peers, aggression is instead tied to provocation (reactive). According to Little et al. (2003), reactive aggression in the individual appears to be directly linked to a deficit in the child's emotional regulation, which can be perceived negatively by peers. In turn, this leads to peers rejecting the child, making him or her even more aggressive (Aimé et al., 2018; Twenge et al., 2001) and heightening the likelihood of developing adjustment difficulties (Bukowski, 2003), such as externalizing problems. In sum, it is expected for activated children to mostly use proactive aggression, while overactivated children are expected to rely more on reactive aggression. Overactivated children are expected to be inflexible in their choice of interactional strategy and lead toward indiscriminate coercion, making them less socially competent.

Paquette and Bigras (2010) also hypothesized an association with internalizing behaviors because anxiety is strongly associated with depression and other internalizing problems. Anxiety and fear are universal emotional

reactions and a part of normal child development (Egger & Angold, 2006a). Anxiety helps locate and quickly respond to potentially dangerous events in the environment (Marks & Nesse, 1994), but excessive anxiety can lead to severe limits in daily functioning (Kroenke et al., 2007). When intense fears persist, intensify, and cause maladjustment and distress in both the child and the child's family, they may indicate the early onset of anxiety disorders (Egger & Angold, 2006b). Given that offspring survival, and thus female reproductive success, relies more heavily on maternal than paternal care, it is important for mothers to stay alive to ensure their offspring survive until sexual maturity (Kanazawa, 2003). Research shows that women engage in more risk avoidance than men (Campbell, 2009; Shan et al., 2012). Girls express fear earlier than boys and show more hesitation and greater distress in approaching novel objects (Campbell, 2009). According to Campbell, the sex difference in fear accounts for a considerable portion of differences observed in aggressive behavior. Indeed, girls commit more relational (or indirect) assaults than boys beginning at age three, with increasing prevalence through to puberty (Vaillancourt, 2005). Paquette et al. (2013) have shown that girls are just as competitive as boys in the dimensions of other-referenced competition and dominance hierarchy maintenance at preschool age when the dimensions have no physical or relational aggression questions.

With small convenience samples, the use of the RS has uncovered negative associations between the score of activation and internalizing problems in toddlers (Dumont & Paquette, 2013) and in preschoolers (Gaumon & Paquette, 2013). Gaumon et al. (2016) found no significant correlation between the activation score and anxiety in a small clinical sample of children being treated for externalizing problems, but the father-child activation score acted as a protective factor in reducing the association between disorganized attachment to mother and preschooler's anxiety. In the same clinical sample, Paquette et al. (2021) showed that overactivated children displayed significantly more externalizing problems than children with either an activated or an underactivated relationship with their father. In a large sample with a significant proportion of educated and financially well-off families, Paquette et al. (2022) found positive associations between mother-infant and father-infant overactivation scores and injury-risk behaviors in toddlers. In this sample, Macario de Medeiros (2021) also found an association between father-child overactivation and externalizing behaviors in preschoolers. The effect size of externalizing behaviors is medium in the convenience samples (risk-taking: $d = 0.52$; externalizing: $d = 0.45$) and large (externalizing: $d = 1.03$) in the clinical sample, large effect sizes can be expected in future research with samples of at-risk families (low-income families, hazardous environments, etc.).

In a convenience sample of 179 infants, Paquette et al. (2020) found a prevalence of 64% of children with an activated relationship to the father (59% to the mother), 22% of children with an underactivated relationship to the father (21% to the mother), and 14% of children with an overactivated relationship to the father (20% to the mother). Father-child dyads had a higher underactivation mean score than mother-child dyads while mother-child dyads had a higher overactivation mean score than father-child dyads. Both father-daughter and mother-daughter dyads had higher underactivation mean scores respectively than father-son and mother-son dyads. Both father-son and mother-son dyads had higher overactivation mean scores than father-daughter and mother-daughter dyads. So, fathers seem to underactive children more than mothers (overprotection problems), and both underactive girls more than boys. Moreover, mothers seem to overactive children more than fathers (control problems), and both overactive boys more than girls.

Sensitivity and the Parent-Child Attachment Relationship

Given that parental sensitivity is one of the best predictors of mother-child attachment (van IJzendoorn & De Wolff, 1997), most validated

early childhood attachment intervention programs target the improvement of sensitive caregiving behaviors in parents (Bakermans-Kranenburg et al., 2003). Maternal sensitivity was defined by Ainsworth et al. (1978) as the mother's ability to respond adequately and contingently to the child's signals in the context of care. Overall, results on the effect of maternal sensitivity on the quality of the mother-child attachment relationship support its importance for the child's development of cognitive and socioemotional competence (Madigan et al., 2019). Both mothers and fathers are able to be sensitive to their child's needs (Hazen et al., 2010). However, the association of the mother's sensitivity with attachment is significantly higher ($r = 0.24$) than that between the fathers' sensitivity and the quality of the father-child attachment relationship ($r = 0.13$) (Lucassen et al., 2011).

Several studies have failed to establish specific links between father sensitivity and father-child attachment (Braungart-Rieker et al., 2001; Brown et al., 2012; van IJzendoorn & De Wolff, 1997; Volling et al., 2002), unlike studies with samples of mothers. Volling and Belsky (1992) have shown that fathers in securely attached dyads are less sensitive than those whose children are insecurely attached, which is rather counterintuitive.

While fathers' sensitivity appears to be related to children's emotional regulation, social skills, overall cognitive functioning, and the prevalence of externalizing and internalizing behaviors, there have also been studies that find weak or no associations between father sensitivity and child cognitive and socioemotional functioning (Hazen et al., 2010; Zvara et al., 2018). Given the variation in results of individual studies examining the impact of paternal sensitivity on child development, Rodrigues et al. (2021) completed a series of meta-analyses. They found an association between sensitive fathering and general cognitive functioning, language skills, and cognitive ability. In addition, children whose fathers were more sensitive scored higher on executive functioning. Overall socioemotional functioning in children was not associated with sensitive fathering. However, children of sensitive fathers were shown to exhibit higher emotional regulation and be less likely to present externalizing symptoms. No association was found between fathers' sensitivity and children's internalizing symptoms. The study also analyzed potential moderators for the associations obtained. Only the age of the child at the time of measurement moderated the results, particularly in the cognitive area, suggesting that cognitive-developmental processes might be at play in the way these variables are related.

Grossmann et al. (2002) showed paternal sensitivity during play with two-year-old children to be a better predictor of attachment 14 years later than father-child attachment as measured by the SSP. However, the meta-analysis by Lucassen et al. (2011) showed that fathers' sensitive play and stimulation were not more strongly associated with attachment security than sensitive interactions without stimulation of play. Some studies have shown that the association between father involvement and attachment depends on the specific types of fathers' activities with children, particularly the frequency of play (Brown et al., 2018; Fuertes et al., 2016). Olsavsky et al. (2020) recently showed that higher levels of paternal stimulation at 9 months using objects or physical means to heighten the infant's arousal during father-infant interactions were associated with secure father-child dyads, whereas paternal sensitivity was not. In addition, they found an interaction between paternal stimulation and intrusiveness: stimulation more strongly predicted secure attachment when intrusiveness was low to moderate. These results support other findings showing that moderate levels of intrusiveness are likely to benefit children's development, thus highlighting an activation parenting profile in fathers and mothers (Lee et al., 2020; Paquette et al., 2000; Stevenson & Crnic, 2013; Volling et al., 2019), even if mothers showed higher levels of sensitivity and lower levels of intrusiveness towards their children than fathers (Hallers-Haalboom et al., 2014). Finally, Brown and Cox (2020) showed that sensitivity and pleasure did not directly predict father-child attachment, whereas pleasure in parenting moderated the association between sensitivity and attachment: fathers were more likely to behave sensitively in

interactions with their children when they took pleasure in their parenting role.

Recently, Deneault et al. (2022) demonstrated in a series of meta-analyses that observed maternal sensitivity is significantly higher than paternal sensitivity, with attenuated results in samples where fathers have greater access to time alone with the infant (Europe, Israel) and can therefore assume the role of principal caregiver, closer to the maternal function.

Sensitivity and the Parent-Child Activation Relationship

Feeney and Woodhouse (2016) emphasize the fact that much of the research on parental sensitivity has not distinguished between sensitivity to distress (safe haven) and sensitivity during exploration (secure base), generally using the term secure base as a shorthand for secure base and safe haven together. Although parental sensitivity is widely recognized as an important predictor of parent-child attachment (Moss et al., 2018; van IJzendoorn et al., 2022), this concept has seldom been considered in the design of studies and predictions made from the standpoint of the activation relationship, which focuses on the exploration of the environment.

It seems realistic to think that paternal sensitivity is an important construct and predictor of the quality of the activation relationship, in the same way that maternal sensitivity predicts the quality of the attachment relationship. To our knowledge, no study has isolated the construct to assess its contribution to the development or quality of the activation relationship. Until now, results suggest the necessity of better understanding the role of parental sensitivity in the specific context of the activation relationship and of the paternal function of opening to the world.

Bissonnette (2019) examined the link between paternal sensitivity and the activation relationship observed during a period of free play without toys. The study comprised the development of an observational measure of paternal sensitivity rooted in the paternal function of opening the child to the world. Following a review of studies measuring parental sensitivity, she proposed a set of behavioral indices organized into five areas of the parent-child relationship (Bell et al., 2012) in which sensitivity can be expressed (*knowledge of the child*, *physical proximity*, *emotional contact*, *interaction*, and *engagement*). Bissonnette characterized paternal sensitivity as the father's ability to identify and respond adequately to the child's needs for stimulation, support in exploration, and limits. The ensuing observational system allows to describe of paternal sensitivity within the relationship, by coding sensitive responses to the child's behavior during highly arousing physical play interactions. Trained observers achieved excellent inter-observer agreement (ICC ranging from 0.86 to 0.95) and the instrument displays very high internal consistency ($\alpha = 0.97$).

Sensitive fathers were observed to adapt their actions to the developmental and behavioral characteristics of their child, use physical distance to regulate the intensity of the interaction, respond in a warm and coherent manner to the child's emotional expression, modulate the intensity of the interaction to ensure emotional regulation, encourage exploration and risk-taking, and set limits to ensure safety. Bissonnette's results show a strong association between a high paternal sensitivity score and an optimal activation relationship ($\rho = 0.74$; $p = 0.001$). A greater proportion of underactivated and overactivated dyads have a father with low paternal sensitivity. Moreover, no dyad classified as overactivated has a father with a high sensitivity score. The association between sensitivity measured in free play without toys and the activation relationship suggests the adequacy of this method of measuring paternal sensitivity within the context of the father-child activation relationship.

Parenting Interventions

Parenting interventions have demonstrated their effectiveness in promoting children's positive social and cognitive development, preventing maltreatment and abuse, and later involvement with child protective services and the justice

system (Moss et al., 2011; Olds et al., 2007; Sweet & Appelbaum, 2004). Most parenting intervention programs are derived from two major theoretical frameworks. Programs based on social learning theories propose to reduce negative parenting practices and increase positive parenting behaviors, such as consistent limit-setting, warmth, and positive reinforcement of the child, effectively reducing children's troublesome behaviors (Fisher & Skowron, 2017). Attachment-based interventions have proven successful in promoting the development of secure attachment relationships by increasing maternal sensitivity and responsiveness (Dozier et al., 2018; Marvin et al., 2002; Mountain et al., 2017). Despite the differences in their theoretical foundations, researchers and clinicians concur on the benefits of incorporating both the relational components derived from attachment theory and the intervention strategies aimed and promoting positive parenting, as proposed by social learning theories. Consequently, supporting caregiver-child dynamic interactions should enhance positive child development (Liu et al., 2021; O'Connor et al., 2013; Toth et al., 2013).

In reviewing the literature on parenting interventions, three main findings stand out. First, fathers are scarcely represented in samples of studies evaluating parenting interventions (Panter-Brick et al., 2014), either because they are not included or because data are not disaggregated by fathers and mothers. Second, most parenting programs are designed to promote parenting competencies related to "mothering" and are fashioned from the standpoint of attachment theory, relying on attachment research for the design of the intervention components, the delivery, and the expected outcomes (Bakermans-Kranenburg, 2022; Panter-Brick et al., 2014). Third, models of the father-child relationship have been driven by the literature on father involvement and engagement (Barker et al., 2017; Pleck, 2010) describing paternal behaviors, attitudes, and values that predict and define paternal involvement as well as factors (proximal and distal) that would facilitate or hinder paternal involvement (Sicouri et al., 2018). Therefore, the intervention programs specifically designed for fathers are centered on promoting paternal involvement and assessing its influence on children's and fathers' wellbeing (Kalembo & Kendall, 2022). While this line of research has proven valid and fruitful, the field lacks specific interventions aimed at promoting and supporting the relationship between the father and his child, targeting the components and variables pertinent to fathering, paternal function, and the activation relationship.

It's Different with Dad! A Parenting Program to Support the Paternal Function

How should a parenting program aiming at supporting the paternal function be different from existing interventions? To answer this question, our team held a series of *focus groups* bringing together a total of 84 fathers, practitioners, parenting and early childhood researchers, and stakeholders. The results were integrated into an extensive literature review of parenting programs, early childhood intervention programs, and research on the influence of paternal involvement on child development, to produce the initial blueprint of the program. This blueprint was then presented to a sample of the initial practitioners, stakeholders, fathers, and researchers for validation (Breton et al., 2009).

The resulting program consists of a series of 10 two-hour group workshops delivered by a male-female team of facilitators on a biweekly basis. Program activities are manualized, and themes for each session are designed around specific objectives for fathers and children in terms of stimulation, exploration, opening to the world, warmth, and control. The workshops are intended to be dynamic, fun, and involve a certain level of risk. Facilitators are trained in the specifics of the father-child relationship, activation theory, and the observation of paternal sensitivity. The "here and now" approach emphasizes supporting fathers in their interaction with their children by becoming the observer of the father's sensitive behaviors and enhancing fathers' awareness of

their positive impact on their child's development.

The program adheres to the following guiding principles:

Strengths-based interventions rooted in observable behaviors The program delivery has a strong activities-based component as opposed to facilitator-directed discussions. Fathers are involved in challenging activities with their children throughout the sessions, and moments of discussion are tailored throughout each session according to the specific objectives of the activity and emerge from the fathers' observations of their own and their child's behavior. One-on-one interventions are carried out as the activities evolve and delivered as "on-the-spot" strengths-based feedback about an observed father-child interaction (Fisher & Skowron, 2017).

Supporting the paternal function of opening to the world A central tenet of the program is the role of fathers in opening the child to the challenges and learning opportunities of his or her environment (Paquette, 2004b; Puentes-Neuman et al., 2006). Therefore, the activities proposed during the sessions are challenging and unusual. For instance, children may be invited to retrieve objects such as plastic critters from a box filled with Jell-O, while blindfolded. Dads may participate in a race pulling their child who is seated on a beach towel. As the activities unfold, facilitators are attentive to the fathers' ability to adequately encourage risk-taking and exploration, as well as how they support, comfort, and set limits for their children. The key to this observation is the appropriateness of the father's intervention relating to the child's ability to adapt to the specific challenge without making it too easy or too overwhelming. As the activity unfolds, the facilitators may approach a dyad and share with the father an observation about the interaction that will highlight the father's positive action and how it benefits his child (Dorion et al., 2022).

Strengthening paternal engagement by attending to fathers' needs in their fathering role Studies examining the reasons for fathers' absence from parenting programs have identified various factors that hinder their participation (Sicouri et al., 2018). Certain socio-economic factors, such as financial stress, may result in the father being less involved with his child and less likely to participate in an intervention program. Also, maternal education level and low financial stress are predictors of fathers' enrollment in the intervention program, while low financial stress and a positive relationship between parents are associated with higher program participation (Wong et al., 2013). *It's different with dad!* attempts to mitigate these factors by delivering activities outside regular working hours, putting forth the specific father-child character of the workshops, offering transportation, and visiting the family to present the program and answer questions before enrollment. Not only fathers are individually invited to participate, but the importance of their involvement in their child's development is highlighted for them and their partners (Kalembo & Kendall, 2022; Panter-Brick et al., 2014).

Fostering an activated father-child relationship The dynamic and challenging nature of the activities proposed throughout the sessions requires that fathers remain attentive to their child's behavior, adapt their interventions to their child's abilities, encourage exploration and risk-taking, comfort the child in case of distress, and set adequate limits to ensure safety and the progression of the activity while participating in a stimulating and fun-filled exchange. By observing the dyads and punctuating father-child interactions with strength-based feedback, facilitators support the building blocks of the father-child relationship, and foster parenting sense of competence and paternal sensitivity (Dorion et al., 2022).

Increase paternal sensitivity Interventions aimed directly at increasing parental sensitivity

are most effective in improving sensitivity and, more moderately, preventing the development of an insecure attachment relationship and its consequences (Bakermans-Kranenburg et al., 2003; Juffer et al., 2018; Moss et al., 2011). Thus, mitigating the impacts of insecure attachment, or even changing the trajectory of the relationship (Moss et al., 2011). Generally, interventions for parental sensitivity are offered to mothers and are designed to increase maternal sensitivity behaviors: attending and responding to distress, comforting, availability, and responding to proximity seeking.

Previous studies of early intervention from an Early Head Start initiative attempting to include fathers in their existing parenting programs report that father-toddler activities aimed at improving the quantity and quality of dyad interactions have several positive effects on the dyad: fathers learn to play with their child and can support the development of different skills; fathers can learn that by paying attention to the child's cues and following the child's pace, it can make interactions more enjoyable while supporting the child's development; fathers can benefit from the support they get from other program members and facilitators (Roggman et al., 2004). However, father participation in these initiatives remains low; the program design, delivery, and objectives are primarily aimed at mothers, while an attempt is made to "fit fathers" into the home visiting program. A recent review of fatherhood intervention research (Henry et al., 2020) concludes that the most effective interventions are group-based, delivered in the community, promote positive parenting, and aim at improving the father-child relationship. By increasing direct father-child involvement through playful activities, it is possible to facilitate the father's ability to attend to the child's cues and respond appropriately. *It's different with dad!* takes this one step further by catering specifically to the activation aspects of the father-child relationship, designing activities that require the father's supportive and attentive presence, and helping fathers, through direct feedback and modeling, to respond adequately and promptly to the child's signals, including by setting limits and comforting the child. The workshops were intended to enable fathers to better support the child's emotional regulation, and afford discipline, stimulation, protection, warmth, and comfort. These factors influence paternal sensitivity as considered from the standpoint of the activation relationship theory.

The general aim of the program is to increase paternal engagement, and promote and support the development of the father-child relationship and specifically the activation relationship while stimulating the child's positive development. For the last 12 years, *It's different with dad!* has been offered as an early intervention program within the social services system in three administrative regions of Québec (Canada). In an earlier implementation of the program, a sample of 34 participating father-toddler dyads was assessed during a home visit prior to the intervention when the children were aged between 12 and 24 months, a follow-up measure was taken when children were aged between 24 and 36 months. Paternal sensitivity was observed in a free-play setting without toys and measured using Bissonnette's (2019) observational tool. Sensitivity increased significantly in the post-intervention measure (F (1, 31) = 7.08, p = 0.012; B = 0.73; η^2s = 0.19) with fathers in the lowest sensitivity category at pretest accounting for an interaction effect between time of measure and level of sensitivity from pretest to post-test (F(2, 31) = 5.30, p = 0.010; B = 0.80; η^2s = 0.26). Post-test comparisons between sensitivity groups established at pretest showed significant differences (F (2, 31) = 4.32, p = 0.022). A posteriori LSD analyses revealed that fathers in the lowest sensitivity category at pretest did not differ significantly at post-test from fathers in the mid-range levels of sensitivity (p = 0.33), suggesting that the least sensitive fathers in the group had caught up to the level of sensitivity observed in the mid-range sensitivity level (Desrosiers, 2022). In an exploratory follow-up of 20 dyads using the attachment story stems at the end of the preschool period, paternal sensitivity during the second year of life of the child was related to secure mental representations of the father as a protective and supportive

figure in an evoked situation generating fear (Beaupré, 2022).

Since 2015, the program has been accessible through community-based organizations offering services to fathers in vulnerable communities (economically disadvantaged, low educational level, fragile housing, occupational status, and rural communities). Using a research-development approach, the activities and objectives were adapted to include preschool-aged children and fathers with more than one child. The program comprises continuing training and clinical supervision of facilitators and ongoing evaluation of implementation and results (Breton et al., 2017). Recent qualitative data from post-intervention clarification interviews (Vermersch, 1994) of fathers, bring to light their appreciation of the experience as an opportunity to know and understand their child better and an increase in parenting competence. Participating fathers' discourse reveals references to the notions of paternal sensitivity and their capacity to support their children's autonomy and opening to the world (Caty, 2020; Dorion et al., 2022; Puentes-Neuman & Cathy, 2021).

Summary and Key Points

We argue that mothers and fathers contribute in complementary ways to children's psychosocial development and adaptation. Whereas children develop attachment and activation relationships with each parent, women will tend to act as the primary attachment figure (performing maternal functions), while men will tend to serve as the primary activation figure (performing paternal functions). Intervening with fathers in ways that foster activating fathering is an effective way to promote healthy child development. Our next steps aim at developing an intervention specifically tailored to increase paternal sensitivity within the activation relationship, by adapting existing parenting interventions based on video feedback and mentalization principles.

- Evolutionary theories propose that maternal and paternal functions are distinct and complementary.
- The activation relationship refers to the child's emotional bond to a parent that fosters the opening to the world, with a special focus on parental stimulation and control during the child's exploration. Fathers tend to assume the primary activating role.
- Underactivation is related to parental overprotection and would be adaptive in a dangerous social or physical environment, while overactivation is related to a lack of parental discipline and would be adaptive in a setting fraught with competition over immediate access to unpredictable resources. Underactivated children will tend to be anxious, while overactivated children will generally tend to use antisocial behaviors.
- *It's different with dad!* is a father-child intervention program aiming at strengthening the father-toddler activation relationship and paternal sensitivity.
- Participation in this strengths-based program increases paternal sensitivity, particularly in fathers with the lowest levels of initial sensitivity.
- Both interveners and fathers report benefits in terms of increased knowledge of the child, paternal engagement, and a sense of competence.

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18

Microanalysis as a Social Microscope: Illustrating with Drawings of the Origins of Disorganized Infant Attachment

Beatrice Beebe

Microanalysis research is uniquely positioned to help us *see more* of the details of the process of mother–infant communication. Human face-to-face (and body-to-body) relating is usually too fast to fully capture with the naked eye (Birdwhistell, 1974; Dimberg et al., 2000; Niedenthal et al., 2010). But the nature of our relationships is formed and transformed in this rapid moment-to-moment process, throughout the lifespan. When we slow it down, or look second-by-second, we see a world of subtle complex relating that we cannot otherwise grasp.

The interactions we study are largely *unmentalized, pre-cognized, not rooted in our usual language-based ways of knowing* (Beebe et al., 2016a). Verbal language usually operates at the forefront of our awareness, and the procedural or nonverbal moment-to-moment movement process is usually largely *out of awareness.* This moment-to-moment movement process is seen in shifts of facial expression, gaze, head orientation, body orientation (such as maternal upright, forward, loom), hand gesture, touch or self-touch; and vocal rhythm, prosody, and turn taking. We may notice some of the more obvious shifts, especially if there is a discrepancy from what we expected. But the more subtle and rapid shifts, which are continuously occurring, are way in the background. This moment-to-moment process has tremendous communicative power. It is an essential means of sensing the partner. These nonverbal patterns define the attentional quality, the affective resonance, the dialogic turn taking, and ultimately a sense of the safety of our relationships. When we translate these unmentalized action sequences into words, we can become more aware of them, think about them, understand their relational function, and use them in clinical intervention.

These rapid moment-to-moment patterns are co-created. It is not only the mother or the parent who leads the interaction and who affects the infant. The infant also affects the parent. By 4 months, infants already enter into exquisitely sensitive, reciprocal, bi-directional exchanges with their social partners (see Beebe et al., 2016b; Bell, 1968; Sameroff, 2010).

In this chapter, I describe our approach to research on face-to-face communication between mothers and their 4-month-old infants. The coordination of face-to-face communication flowers at 3–4 months (Stern, 1985). Four to six months is an important developmental period. Across ethnicities and cultures, mother–infant communication in the early months of life predicts developmental outcomes, including infant brain development, physiological regulation, emotion regulation, the capacity for empathy in childhood and adolescence (see e.g., Bernier et al., 2016;

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Moore & Calkins, 2004; Feldman, 2007; Leerkes et al., 2009; Tronick, 1989; Apter-Levy et al., 2013), as well as infant attachment and cognition (Leyendecker et al., 1997; Jaffe et al., 2001; Beebe et al., 2010).

In our research lab, the mother is asked to play with her infant as she usually would at home, but without toys, as her infant sits in an infant seat across from her. Two cameras, one on each partner, videotape a split-screen view. We use a dyadic systems view of communication and second-by-second video microanalysis. I illustrate our approach with some findings from our research on the 4-month origins of disorganized (vs. secure) attachment. In the discussion, I address implications for clinical intervention.

In our dyadic system view, each person's behavior is created in a process of bi-directional coordination. Although the parent has greater range, control, and flexibility, both partners actively contribute to the exchange; both partners co-create patterns of relatedness (Beebe et al., 2016b; Messinger et al., 2012; Sameroff, 2010; Sander, 1977; Tronick, 1989).

Using video microanalysis coding, our goal is to understand how the communication works. Usual methods of more "global" coding, such as judgments of "sensitive" maternal behavior, or "positive" infant behavior, do not allow us to see the moment-to-moment process (Beebe & Steele, 2013). Instead, we study the communication precise to the second when using video (and to the quarter second when coding vocal rhythm: see Jaffe et al., 2001). Moreover, even video microanalysis coding approaches in the literature often code only a couple of channels, such as gaze or vocalization (e.g., Hsu & Fogel, 2001; Morelen et al., 2016). Our effort to capture all the visible modes of communication, as well as vocal timing, as a 4-month infant plays face-to-face with her mother is rare. Our approach captures attention, emotion (both facial affect and vocal affect), orientation and touch, and the temporal patterns of vocal dialogue.

In our research, we have addressed risk issues such as being pregnant and widowed on September 11, 2001 (Beebe et al., 2020, 2023), infant prematurity (Beebe et al., 2018; Lavelli et al., 2022), maternal depression (Beebe et al., 2008), maternal anxiety (Beebe et al., 2011), maternal self-criticism (Beebe et al., 2007), and the 4-month origins of 12-month infant attachment patterns (Beebe et al., 2010). In this chapter, I illustrate our approach with some of the findings from our research on the 4-month origins of 12-month infant disorganized (vs. secure) attachment using the Ainsworth Strange Situation paradigm (Beebe et al., 2010; Beebe & Steele, 2013; see also Beebe et al., 2016a).

Whereas face-to-face communication taps the moment-to-moment process of relating and accrues to intimacy and social connection, attachment assessed by Ainsworth et al.'s (1978) Strange Situation utilizes a separation–reunion paradigm and taps infant expectancies that the caregiver is safe and available after a separation; or expectancies of unavailability, or even possibly threat. Based on the extent to which the infant uses the parent as a safe haven after the separation, and as a secure base from which to return to play, infants can be classified into one of 4 attachment patterns. Whereas infants classified as secure can recover easily from the separation, use the mother as a secure base when distressed, and return to exploring the environment, infants classified as insecure spend too much or too little time using the mother as a secure base, or exploring the environment, upsetting a balance between attachment and exploration.

Of the three categories of insecure attachment yielded by the Strange Situation (avoidant, resistant, and disorganized), our interest here is in disorganized attachment. In the reunion episodes, disorganized infants at 12–18 months show incomplete movements, contradictory approach/avoidance patterns, confusion, apprehension, and momentary stilling, considered a breakdown in behavioral organization (Main & Solomon, 1990). Mothers of disorganized infants often suffer from unresolved loss, abuse, or trauma, and continue to be fearful (Lyons-Ruth et al., 1999; Main & Hesse, 1990). Within the Ainsworth Strange Situation, mothers may display frightened and/or frightening behavior (Lyons-Ruth et al., 1999).

In research at the group level, for example, comparing secure vs. disorganized infant attachment groups, a secure attachment at 12–18 months

is associated in childhood with better peer relations, school performance, capacity to regulate emotions, and less psychopathology (Sroufe et al., 2010); in adulthood with more optimal romantic relationships (Feeney & Noller, 1990) and more optimal parenting (van Ijzendoorn, 1995). In contrast, disorganized attachment at 12–18 months predicts, for example, externalizing disorders in childhood (Lyons-Ruth & Jacobvitz, 2008), and insecurity (Weinfield et al., 2004) and dissociation in adolescence (Ogawa et al., 1997). Nevertheless, disorganized infant attachment does not inevitably cause later problems (Granqvist et al., 2017); clinical interventions as well as naturally occurring positive experiences can alter the course of development. In addition, disorganized infant attachment is not a validated individual-level clinical diagnosis (Granqvist et al., 2017).

An unusual component of our research approach is that, after we analyze the data and have our findings, we then go back to the original videotapes to see where these findings are visible. For example, in our analysis of the 4-month origins of disorganized attachment described below, we found patterns that we did not know about, and, hence, had not coded, namely various maternal threat faces, such as disgust, searing disapproval eyebrows, or open-mouth bared-teeth faces. In this chapter, video frames and drawings of video frames will be used to illustrate some of the differences we documented between dyads at 4 months who are on the way to secure, vs. disorganized, infant attachment at one year. A talented artist[1] drew some of the film frames to disguise the mothers and infants to preserve their confidentiality, and to retain the emotional and bodily expressions. This visual grounding gives the research findings a visceral, intuitive, and immediate form of comprehension. The findings come alive clinically.

Thus, the data analysis *teaches us to see more*. Video microanalysis is a research tool, a training tool, and a treatment tool. It helps us learn to observe the intricate process of a dyadic, nonverbal dialogue just below perceptible view in real time. In the illustrations below, I try to translate from the unmentalized, pre-cognized procedural action sequences into words, to better reflect on them (Steele et al., 2022). This is the process that can inform clinical intervention.

The 4-Month Origins of Disorganized Attachment: A View from Microanalysis

In our research on the origins of attachment (Beebe et al., 2010), we compared the 4-month interactions of two groups: 47 mother–infant dyads where the infants were classified as secure attachment at 12 months and 17 mother–infant dyads where the infants were classified as disorganized attachment at one year. Comparing the two groups, we were able to predict attachment outcomes at one year from just 2½ min of videotaped interaction per dyad at 4 months, coded to a 1-s time base. This illustrates the power of microanalysis. It also illustrates the fact that relatively small amounts of nonverbal communication carry enormous information (Ambady & Rosenthal, 1992). Thus, aspects of attachment are already in place at 4 months, in subtle processes of face-to-face communication. In the illustrations of the 4-month origins of secure and disorganized attachment below, I attempt to put words to the behaviors I see.

Illustration of Secure Attachment and Distress Moments

Distress moments are normative, ordinary, rather than "disruptions." Infants are often briefly distressed. In contrast, very frequent distress is associated with disorganized attachment and other problematic outcomes (NICHD Early Child Care Research Network, 2004).

The film frames below[2] illustrate a momentary infant distress and an optimal, sympathetic maternal response to an ordinary distress moment during a face-to-face interaction at 4 months. As we enter this interaction in

[1] Dillon Yothers.

[2] Courtesy of mother's permission, documentary film protocol.

Fig. 18.1, *frame 1*, the baby is oriented to the mother, and both are smiling. In Fig. 18.1, *frame 2*, 1 s later, the heads go down together, and the infant's face dampens. In the far-right bottom corner of the infant's frame, you will see the mother's right hand move onto the infant's seat.

Fig. 18.1 Secure attachment dyad. Frame 1: Both smiling; Frame 2: Heads go down together and infant's face dampens

In Fig. 18.2, *frame 3*, about 2 s later, watch the baby's left-hand splay out. Something has surprised him. And mother's face seems to say, "What happened?" Was it mother's hand in the prior frame that surprised him? Here *in frame 3*, we also see mother's hand reaching in toward the left side of the infant's seat. In Fig. 18.2, *frame 4*, about 8 s later, they both say, "That was surprising" as the eyebrows of both go up together.

Fig. 18.2 Infant and mother are surprised. Frame 3: Infant's left hand splays out; Frame 4: Eyebrows of both go up in surprised expressions

In Fig. 18.3, *frame 5*, mother now touches the infant with her left hand, perhaps to reassure. The infant's face communicates, "I didn't like it." See the subtle bit of distress on the right side of the baby's mouth (baby's own right side) pulled slightly sideways. The mother's face says, "I'm sorry!" with a "*sympathetic woe face*." In Fig. 18.3, *frame 6*, the infant's face communicates, "Yeah, it's bad." And mother's face says, "Well, I'm really sorry!" again with a sympathetic woe face. *These two moments are key.* This mother joins the infant where he is, in a distressed moment, in a sympathetic way. And she does it twice. This sympathetic acknowledgement of distress is something mothers of future disorganized attachment infants have trouble doing.

Fig. 18.3 Twice, mother responds to infant distress with empathetic woe face

In Fig. 18.4, *frame 7*, later in the same sec, the mother's face now says, "Well, maybe it's not that bad," with a hint of a smile, and the infant's face seems to communicate a wary expression, "I don't know." In the next sec, *frame 8*, the infant's face sort of reluctantly says, "Okay, okay," and the mother smiles broadly. In the final *frame 9*, 7 s later, both are really happy. The infant lights up and his head goes up.

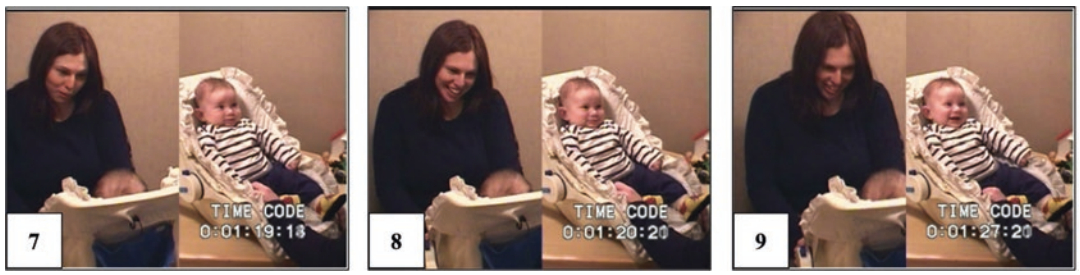

Fig. 18.4 Regaining positive engagement. Frame 7: Both are still tentative; Frame 8: Infant begins to smile while mother smiles fully; Frame 9: Both smile fully

When this film is viewed in real time, we do not see these details; we just see an adorable mother and infant. We do not see how the mother joins the infant's distress for a couple of moments. We do not see how the baby comes out of it slowly. We cannot catch that in real time.

Sympathetic Woe Face to Infant Distress

Figure 18.5 gives another example of *sympathetic woe face* in response to infant distress. In Fig. 18.5, *drawing 1*, the woe face is combined with surprise. Notice in Fig. 18.5, *drawing 2* that the mother puts her hand on the infant's chest, and the infant begins to curl his hands over the mother's hand, presumably a self-comfort effort.

Fig. 18.5 Sympathetic woe face. Drawing 1: Sympathetic woe face with surprise; Drawing 2: Sympathetic woe face with a furrowed, concerned brow and a sadness expression

Illustrations of Disorganized Attachment

In what follows, I illustrate some of the findings from our research on the origins of disorganized (vs. secure) infant attachment at 4 months (Beebe et al., 2010). "Findings" always refers to Beebe et al. (2010). "Future" disorganized (or secure) means infants at 4 months who will be classified disorganized (or secure) attachment at 12 months. For further illustration, see Beebe et al. 2016a, *The Mother-Infant Interaction Picture Book: Origins of Attachment*, with over 200 drawings illustrating secure, insecure, and disorganized infant attachment patterns at 4 months, drawn from this research.

Infant Distress and Maternal Response

In our findings, infants on the way to disorganized (vs. secure) attachment showed far more distress, especially vocal distress (fuss/whimper, angry protest, cry), but also combined vocal and facial (frown, grimace, compressed lips, pre-cry face, cry-face) distress. Mothers of future disorganized (vs. secure) infants were more likely to show smiles or surprise faces at moments of infant distress: a failure of sympathetic recognition, a facial "denial" of infant distress. Figure 18.6, *drawing 1*, illustrates mother smile to infant distress; *drawing 2* illustrates mother mock surprise to infant distress. We proposed that infants may feel not sensed, not recognized, not "known" at such moments (Beebe et al., 2010).

Fig. 18.6 Smile or surprise/mock surprise to infant distress. Drawing 1: Mother smile to infant distress; Drawing 2: Mother mock surprise to infant distress

Maternal Look Away

Looking is arousing. We look away to down-regulate our arousal (Field, 1981). Mothers of infants on the way to disorganized (vs. secure) infants looked away from their infants for longer periods and looked at and away less predictably. Perhaps the distress of their infants generated heighted arousal in these mothers. Perhaps mothers looked away as a procedural (out of awareness) effort to decrease arousal. But because mutual gaze is the foundation of the face-to-face encounter (Stern, 1985), greater maternal looking away likely decreases the ability of the dyad to engage in mutual gaze. Moreover, because maternal look-away often occurs when infants are distressed, looking away leaves the infant alone in his distress, *not seen*.

In Fig. 18.7, *drawing 1*, we see the infant slightly arch back, with a distressed facial expression, a partial grimace. Mother looks down, and her eyes are probably closed. She gives the impression, of being inward, far away, with a hint of sadness. In Fig. 18.7, *drawing 2*, we see another very distressed infant, with a full grimace. Again the mother looks down, and she also has a sad face. Her eyes look closed, and she has a far-away look. Both these drawings give the impression that the infant's distress feels unbearable to the mother.

Fig. 18.7 Mothers look away from distressed infants

Loom

We coded mother spatial orientation as sitting upright, leaning forward, and looming into the infant's face. Mothers of future disorganized infants (vs. secure) were more likely to loom. Main and Hesse (1990) considered loom movements at 12 months to be frightening. These mothers were also more variable (less predictable) in their moment-to-moment orientation positions. Thus, these mothers not only loomed but they did so in a less predictable way. Both may be threatening to infants. We dubbed this finding an "unpredictable spatial frame."

In Fig. 18.8, *drawing 1*, we can gauge how close the mother is to the infant by the bit of her hair that shows up in the far-right side of the infant's frame. The infant is beginning to bring his hands up, as if to protect his face. His eyebrows show distress. In Fig. 18.8, *drawing 2*, we see the mother closer into the infant's face (look again at her hair in the far-right side of the infant's frame). Now the infant brings his hands up higher, covering his face, in a self-protective move. Notice that the mother's face is relatively neutral in *drawing 1*. She seems not to sense or facially acknowledge the infant's beginning distressed reaction to her loom. In *drawing 2*, she slightly shifts: her mouth opens, her bottom jaw juts out, and her eyebrows are raised. Here she clearly notices something about the infant's reaction, but she does not facially acknowledge his discomfort. There is no empathic "woe-face."

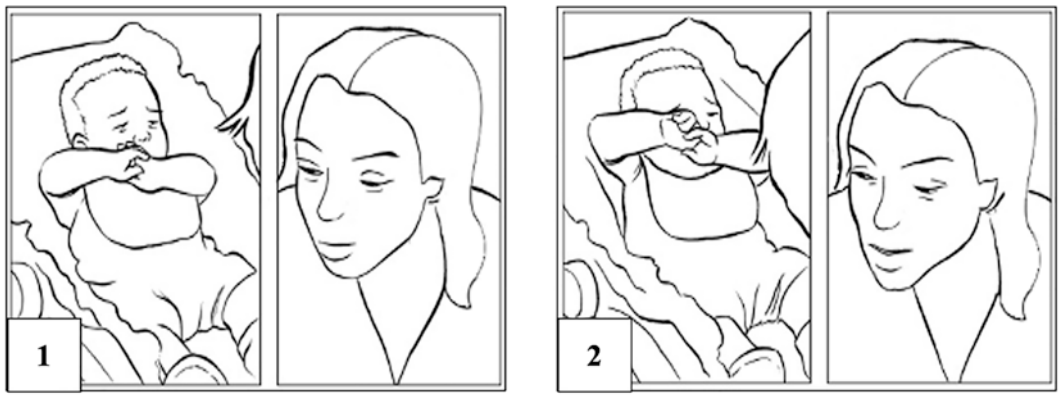

Fig. 18.8 Mother loom. Drawing 1: The mother's closeness to the infant's face can be gauged by the bit of her hair that shows up in the infant's frame. Drawing 2: the mother is even closer, as seen by a larger portion of her hair in the infant's frame. Here the infant puts his hands up fully, seeming to protect his face

Figure 18.9 provides a second example of maternal loom. In Fig. 18.9, *drawing 1*, notice how much of the mother's hair you see in the infant's frame. The mother is already very close. The infant is looking, with a grimace face, and with a bottom lip partially pulled in. But the mother has a big smile. In Fig. 18.9, *drawing 2*, the mother comes in even closer and continues to grin, as the infant dips his head down more, looking down, with his mouth in a "compressed lips" expression, indicating tension, and with a hint of the grimace. But she is not processing what the infant is expressing. In Fig. 18.9, *drawing 3*, the mother looms in even closer, with an even bigger smile. The infant dips his head down even further, with a shut-down look, and a hint of sadness. In Fig. 18.9, *drawing 4*, the infant is overtly sad, with distressed eyebrows. Only now does the mother begin to understand that he does not like it. So, he tells her three times before she backs off.

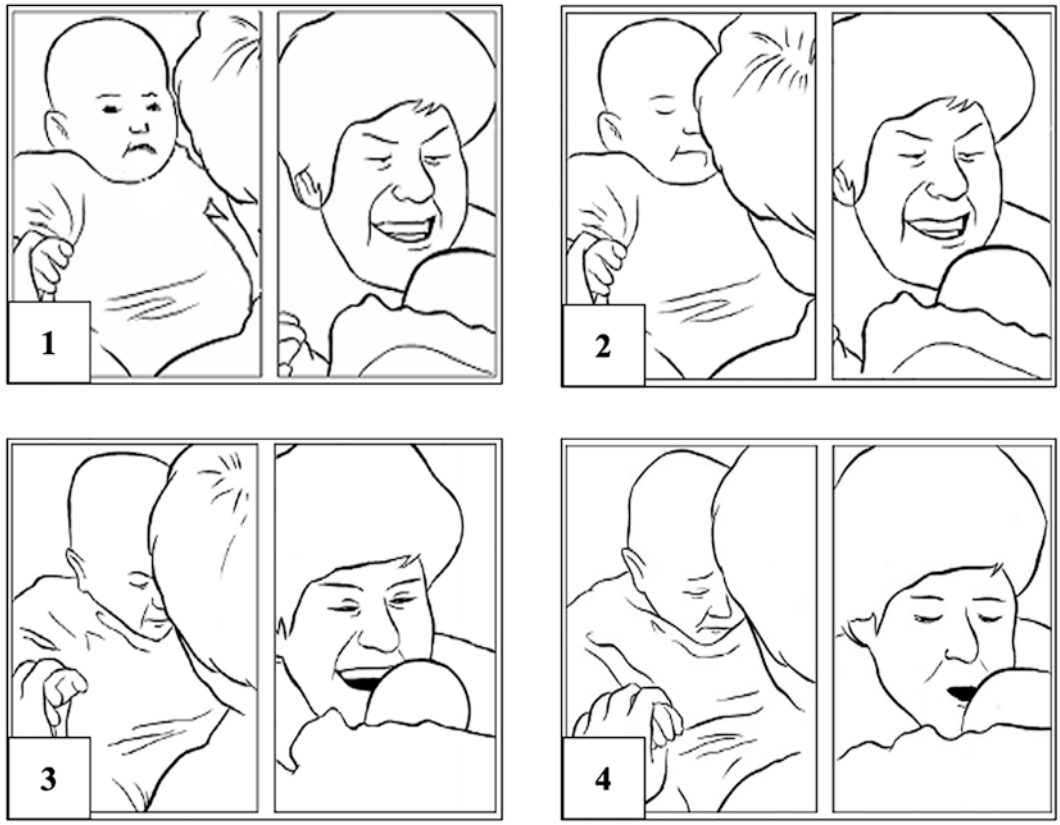

Fig. 18.9 Mother loom. In the first three drawings, the mother comes in close to the infant's face, smiling broadly; she does not seem to notice that he is saying no, with increasing intensity. Drawing 1: The infant grimaces; Drawing 2: The infant grimaces and closes his eyes; Drawing 3: The infant grimaces, closes his eyes and puts his head down. Drawing 4: Only here does the mother notice the infant's distress and back up

Closed-Up Face

It is unusual for mothers not to shift their faces and movements from moment to moment. Mothers of future disorganized infants had "over-stabilized" faces, that is, faces that were more likely to stay the same (vs. vary) for several moments. These faces were like a momentary "still-face" in the Tronick et al. (1978) still-face experiment. Figure 18.10 illustrates a maternal over-stabilized face.

In Fig. 18.10, *drawing 1*, the mother pushes the infant's head back, a bit roughly. The infant's eyes are down, and his face is sober. To understand this sequence better, I looked at the actual film frames that the drawings were taken from. As the mother pushes the infant's head back, the infant's right hand rises abruptly, with the fingers splayed out; the legs drop down, and the toes of the right foot splay out. In Fig. 18.10, *drawing 2*, the mother touches the infant's head roughly. The infant looks at her with a distressed face. His right hand and right foot jerk upward, toes pointed. In *drawing 3*, mother again pushes his head roughly; he becomes more distressed, with a grimace and distressed eyebrows. Across the 3 frames, mother's face seems impassive. She barely reacts, as if to say, "I can't go there," or "I won't go there." The infant's distress may trigger

Fig. 18.10 Mother closed-up face. Across the 3 frames, the mother pushes the infant's head. As the infant becomes increasingly distressed, the mother's face does not show any reaction to the infant's distress

her own unresolved distress. If she were to remain empathic, she might fear finding herself in the original traumatized state of her own history. Momentarily closing her face may be a self-protective effort.

Maternal Threat Faces

We did not know about the maternal threat faces in our original research on the origins of disorganized infant attachment. After publishing our findings, we went back to the videotapes to see where our findings were visible, and we discovered threat faces. From the real-time film, we saw the infant below intensely uncomfortable when the mother's finger went into his mouth.

In Fig. 18.11, *drawing 1*, the mother puts her finger in her infant's mouth, with a disgust face. Clinically, our best hypothesis might be that someone in the mother's own childhood found her distress as a child disgusting. In Fig. 18.11, *drawing 2*, the mother shows a bared-teeth bite-face, which is vestigial threat. The feeling is, "I'm going to bite you." The infant closes his eyes, as if to say, "Don't look." We conjecture that the infant's distress triggered in the mother an unbearable, unresolved distress of her own that she could not manage, and that she was only dimly aware of. Thus, we conjecture that this mother threatened her infant because she felt her infant was threatening her.

Once we discovered threat faces, coders blind to attachment category then recoded a subset of the data comparing the frequency of threat faces in secure (N = 23) vs. disorganized dyads (N = 17). The threat was coded as the presence/absence of any of the following: disgust

Fig. 18.11 Maternal threat faces. Drawing 1: Disgust face; Drawing 2: Bared teeth bite-face

(nasolabial fold), sneer, gritted teeth, bared teeth, bite-face, whites of eyes visible, chin jutting. Threat was a rare behavior (secure 0.4% time, disorganized 1.1% time). Inter-rater reliability was performed on 22% of the dyads ($N = 9$). For dyads with sufficient variability, $K = 0.82$, $p < 0.01$. For dyads with insufficient variability to calculate kappa, the mean percent agreement was 98.4%, range 94%–100%. The power to detect effects was thus low, but Fisher's Exact Test for Count Data for group differences was almost significant ($p = 0.066$).

Expectancies

The *moments* captured in the drawings above are examples of repeating, predictable *patterns* identified by our analyses comparing secure vs. disorganized dyads (Beebe et al., 2010). Infants come to procedurally represent these repeating patterns. They are contingency detectors from birth, with remarkable capacities to estimate probabilities of "if-then" sequences which generate "expectancies" (Haith et al., 1988). Infants on the way to disorganized attachment, as well as their mothers, thus come to expect the patterns of "how I affect you and how you affect me," depicted in the drawings.

Discussion of the 4-Month Origins of Disorganized Attachment

It was difficult for mothers of future disorganized infants to empathically acknowledge infant distress. The mothers' unresolved trauma history helps us understand these mothers. They were likely exposed to fearful and threatening experiences in childhood. When their infants become distressed, it may trigger fearful, angry, and helpless feelings in the mothers. We conjectured that these mothers could not acknowledge infant distress because they could not bear their own. Thus, mothers of future disorganized infants may threaten their distressed infants because their infants' distress may threaten the mothers. We proposed that 4-month infants on the way to disorganized attachment may come to experience and represent *not being sensed, known, or recognized* by their mothers, particularly in moments of distress.

In what way might our findings shed light on the prediction of young adult dissociation from disorganized attachment at 12–18 months? Unresolvable threat (Porges et al., 1994; Siegel, 2012) and non-recognition (Bromberg, 2011; Benjamin, 2017) are important theories of the origins of dissociation. Our findings further specify and lend support to these theories. *Maternal threat*, for example, is evident in our data in many patterns, such as maternal positive faces or mock surprise faces greeting infant distress, looming into the infant's face, disgust faces, sneer faces, and open-mouth, bared-teeth "bite faces." *Infant signs of alarm* are visible in many patterns, such as frantic levels of vocal and facial distress, moving the hands up and back into a "don't touch me" pose as mothers' loom. *Forms of maternal non-recognition* are evident in our findings in many patterns, particularly in the context of infant distress, for example, maternal inscrutable, closed-up faces (infant loses maternal responsivity); maternal unpredictable looking away (infant may feel unseen); maternal smile or mock surprise face to infant distress (which may disturb infant confidence in the validity of his experience). These experiences may set a trajectory in development which biases toward dissociative defenses in young adulthood. Failures of recognition at 4 months provide an expanded view of the kinds of threat that may lead to dissociative processes (Beebe & Lachmann, 2014).

The research describes the things that we "feel" in our interactions with specific people in our lives but cannot pinpoint or describe; the things that happen that are not processed in conscious awareness. We do not grasp them until we see them in slowed-down video or through microanalysis.

Microanalysis in Mother–Infant Treatment

Although my main purpose in this chapter is to use our research on the origins of disorganized infant attachment to illustrate the power of video microanalysis in illuminating the moment-by moment interactions of mothers and infants, below I give a few examples of how this approach can be useful in mother–infant treatment. The use of video in mother–infant treatment is not new; for reviews, see, for example, Steele et al., 2014, 2022.

I am not advocating a particular approach to treatment, nor even a requirement that video be used. I give two kinds of clinical examples below. (a) In the first, the Linda and Dan case, I illustrate how the use of slowed-down video or microanalysis can inform the clinician in a way not otherwise possible. (b) In the second, through case vignettes of Dr. Inga Blum, I illustrate how this research can teach clinicians to *see more*, even when video is not used.

Linda and Dan

One mother despaired because she felt her infant did not love her, did not even know her. She complained that he never looked at her. This is the "Linda and Dan" case, treated by Cohen and Beebe (2002). A videotape of the interaction run in real time showed that it was true that the infant was mostly looking away from the mother's face. Overall, the mother's stimulation was very high and intense, and probably too much for this infant.

But microanalysis revealed a more complex story. Whenever Dan did look at his mother's face, the mother interrupted the moment. The first time Dan looked at the mother's face, in that same split-second the mother looked at the camera, with a sad face, as if to say, look what a hard job I have (she knew that her therapist, husband, and I were outside the filming chamber watching). By the time she looked back at Dan, he was already looking away. The second time Dan looked at her, she failed to greet him; her face was blank. But 2 s later, she smiled. Even though she was late in greeting him, Dan then warmed up, with an open-mouth positive-attention face, not quite a smile: the most positive moment of the interaction. But the next time Dan looked, the mother responded with a sad partial-grimace face. And Dan immediately looked away. Meanwhile, even as Dan moved his head away and looked away, over and over he reached for his mother's hands and lightly fingered them. Even when his mother pulled her hands away from him, Dan followed her hand movements with his own hands, attempting to continue touching her hands. This description is based on 33 s of video.

Two critical aspects of this interaction were not visible when the film was run in real time: the ways that the mother disrupted the moment of the infant looking at her, and the ways in which the infant continued to reach for her despite his looking way. This nuanced and complex information can richly inform a treatment strategy.

If a clinician is interested in video, split-screen video is not necessary, and the clinician's smart phone or any camera can do the recording. A half minute of recording is usually adequate. The recording should get a side view of the mother's face and the full *en face* view of the infant's face. In this way, the clinician and the camera are not directly in the mother's view, so that her interaction with the infant is least disturbed. And in the era of telehealth, so much more is possible—recording is easier, and it is easier to join in the viewing together.

It is easy to slow down the video to see more of the details. Slow motion playback or "scrubbing" is available across viewing platforms. From your smartphone (or computer), you can manually move the cursor back and forth across the video timeline (located at the bottom of the video clip), across approximately 1 s of video (30 frames). This is called "video scrubbing." Or, with one finger on the mouse, you can click-click-click, which moves the images in slow motion. *You will be able to see the mother and infant both move in relation to the other's movement pattern*.

Inga Blom Cases

Inga Blom, Ph.D. is the Program Director, the Reproductive Mental Health, Lenox Hill Hospital, Department of Psychiatry, New York City, and a longtime member of one of my study groups. She describes two case vignettes below which illustrate how a therapist familiar with my work applied it at specific moments in two different mother–infant treatments, even without videotaping.

Jennifer presented with profound dread in the months before her daughter's birth. She did not remember any specific experiences in her early life. Intense tearfulness could arise at any moment. She could not name feelings, identify triggers, or verbalize experiences. At times Jennifer's face would take on a blankness—like Beebe's over-stabilized "closed-up" faces in the origins of disorganized attachment—that could last several moments. Knowing Beebe's research helped me. I was able to recognize Jennifer's closed-up face, and think about it, instead of reacting with withdrawal. The research helped me to be empathic and curious, at the most challenging times. It helped me stay close to Jennifer's experience.

Sonia was a new mother who grew up in an abusive family. She often felt either enraged or numb. She said of her baby, "I don't feel like his mom." Relying on words proved too intense: "Talking and saying things, I feel flooded and out of control." In remote video-chat sessions, I tried to join Sonia's pace and tone and facial emotions. This is Beebe's way of interacting with infants as well as adults, trying to join them where they are. At one powerful moment, Sonia was lamenting her lack of connection to her son, but out of her awareness, her face and vocal tone responded to her son's, who was in a baby seat beside her. Their faces and bodies moved together. I was able to point this out to her, how very attuned she was to her son. I also helped her see her son's joyful smiles and attentive gazes in return. This moment of recognition, when the mother could notice her own ability to connect, began to change this mother's experience of her son.

Summary and Key Points

Because face-to-face relating is usually too fast to fully capture with the naked eye, video microanalysis research can help us *see more* of the details of mother-infant communication. When we slow it down, or look second-by-second, we see a world of subtle complex relating that we cannot otherwise grasp. Thus, video microanalysis is a research tool, a training tool, and a treatment tool.

In this chapter, I illustrated our approach with drawings of some of the findings from our research on the 4-month origins of 12-month infant disorganized (vs. secure) attachment. After we analyzed the data, we went back to the original videotapes to see where our findings were visible. Talented artists[1] drew some of the film frames of the patterns the research identified, to disguise the mothers and infants to preserve their confidentiality, but to retain the emotional and bodily expressions. This visual grounding gives the research findings a visceral, intuitive, and immediate form of comprehension.

In the origins of secure attachment, we saw how another mother's rapid, subtle recognizing and empathically joining her infant's distress enabled the infant to quickly recover. In the origins of disorganized attachment, we saw interactions that made us gasp, such as a maternal bared-teeth bite-face to her infant who was frantically distressed. Thus, the data analysis *taught us to see more*.

The rapid micro-momentary process that we study is largely unmentalized, not rooted in our usual language-based ways of knowing. Verbal language usually operates at the forefront of our awareness, and the procedural or nonverbal moment-to-moment movement process is usually largely *out of awareness.* In this chapter, I tried to translate from the unmentalized, pre-cognized, procedural action sequences into words. This is the process that can inform clinical intervention.

Once our video microanalysis research identifies patterns associated with risk, a visual translation with slowed-down video, video frame-by-frame analysis, or drawings of

frames enables us *to learn to look for these patterns*. Attempts to translate these movement patterns into language then help us think about these patterns, imagine the infant's and the mother's experience in these moments, and enhance the capacity of the clinician and the parent to draw connections between the movement patterns they see and the difficulties the parent experiences (Steele et al., 2022). This process is illustrated in the clinical vignettes by Inga Blom.

Clinicians often feel that video is beyond their purview. But a lab is not necessary. Clinicians have the tools at hand—their smartphones or zoom can do the recording. Slow motion playback, "video scrubbing," is available across viewing platforms. Remote screen sharing allows clinicians to easily look at videos together with mothers and other professionals. Video microanalysis provides a powerful social microscope which can transform our approach to mother–infant treatment.

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The Influence of Fathers on Infant Development

19

Avery Hennigar and Natasha J. Cabrera

Fathers are no longer the "forgotten parent" or the "invisible parent." A steady stream of research beginning in the 1970s began to dispel the myth that fathers are not interested in the day-to-day care of their children and show that fathers' emotional support contributes to their children's development (Fitzgerald et al., 2020). Spurred by large demographic shifts in family formation as well as cultural changes that view fathers as caregivers, the last three decades have seen an unprecedented interest in research on how fathers impact their children's lives (Cabrera et al., 2018; Lamb, 1975; Schoppe-Sullivan & Fagan, 2020). During the late 1990s, motivated by the National Fatherhood Initiative, Federal agencies made a pivotal change to solve the so-called "missing men" problem, that is, the absence of national data on fathers' parenting behaviors. Specifically, a policy focus on fathers motivated federal agencies to collect data directly from fathers themselves (e.g., the Early Childhood Longitudinal Study-Birth Cohort, ECLS-B; the Future Families Study (FFS)—formerly the Fragile Families Child Wellbeing Study) and allocated federal money to fund the establishment of responsible fatherhood programs (Cabrera et al., 2000; National Fatherhood Initiative, n.d.). The development of key initiatives (e.g., the Healthy Marriage and Responsible Fatherhood grants awarded by the Office of Family Assistance) resulted in national data on fathers, which facilitated the study of fathers' influence on child development. Researchers followed suit and also designed studies that included rich observational data on father–child interactions. Together, national data and data from small studies make it possible for researchers to piece together a story about the role that fathers play in the cognitive, social, and physical development of their children.

Against this backdrop and despite the growing political, cultural, and scholarly emphasis on fathers, compared to mothers, fathers are still excluded from most studies of child development and parenting, in particular from studies that focus on infancy (Cabrera et al., 2018). Consequently, there is a dearth of information on how fathers' impact the normative development of infants. This is an important gap in our knowledge because infants who have supportive and caring relationships with their caregivers, including fathers, in tandem with rich learning environments during the first years of life have lifelong benefits for learning, behavior, and physical and mental health (National Scientific Council on the Developing Child, 2007). It is then important to understand what we know about the father–child

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relationship during the early years and where are the gaps with an eye to guiding the next generation of father studies.

Although we cite research from a variety of countries, in this chapter, we synthesize the available empirical evidence, drawn primarily from the United States, on the influence of fathers on children's development during the early years of life (birth to age 3). Our research begins in the 1990s and includes studies that measured a child development outcome as the dependent variable to highlight the literature that explicitly examines the effects of fathers on child development. We organize this chapter as follows. We first present a short discussion on the theoretical and methodological approaches that have been used to conceptualize and assess fathers' contributions to infant development. We do so because it will give the reader a good idea about the types of evidence we need to have to make theoretically based conclusions about father effects. Next, we discuss the empirical evidence that focuses on fathers' direct impact on children's social and emotional, language, cognitive, pre-academic, and physical development. We then discuss the individual- and family-level characteristics that explain some of the variation in fathering behaviors. We conclude with a summary and discussion of future directions.

Theoretical Foundations

There is no one theory that fully encompasses the complex and dynamic way in which fathers influence their children's development. Instead, fatherhood researchers have availed themselves of foundational developmental theories that are particularly relevant when considering the influence of parents on their infants and young children. A commonly used framework is Bronfenbrenner's bioecological model (Bronfenbrenner & Morris, 2006). Essentially, the bioecological models theorize that children are embedded within an intersecting environmental system that shapes their developmental trajectory. According to this theory, children are socialized through their microsystem (i.e., the early home environment, childcare), or their immediate and most proximate environments where individuals present within these environments (parents, caregivers, teachers). This model also suggests that children are influenced by the interrelation between microsystems, known as the mesosystem. The positive interactions between children's proximal environments are significant for supporting children's optimal growth and development. In addition to these proximal influences on children's development, there are also distal influences. The exosystem (e.g., parents' work environment) and macrosystems (for example, culture, norms, policies) have an indirect effect on children through its effects on the mesosystem and the microsystem. The cascading influences of polices, cultural values, and norms reach the child through the interaction with other subsystems. During the early years, an infant's microsystem consists primarily of their home environment and the relationships with their parents. These early interactions between children and their caregivers are critical because they set the stage for future development and can place children in a positive or negative trajectory.

Attachment theory is another keystone theory for conceptualizing parent–child relationships during infancy and early childhood. The psychologist John Bowlby's (1969) seminal work around attachment theory has been the primary framework for decades of research on parent–child relationships. Bowlby proposed the concept of attachment to describe the enduring emotional bond between children and their parents. This theory consists of three central hypotheses: a mother's ability to sensitively respond to their child's signal will predict attachment security, children with secure attachments will possess greater social competence, and infants will be more likely to explore their environments in the presence of a secure base (i.e., an attachment figure; Bowlby, 1969). Bowlby did not believe that children's biological mothers are their only primary attachment figures and hinted that other females could provide such care. However, he (and others) did not consider fathers as primary attachment figures or relevant to caregiving.

Collaborating with Bowlby, the psychologist Mary Ainsworth showed that attachment is not an "all-or-nothing" process as Bowlby believed, but rather it comprises of a set of "attachment behaviors." She used the Strange Situation procedure to identify individual differences in infant attachment security and concluded that through secure and trusting relationships with their mothers, infants form, and use internal working models (IWMs), which are experience-based cognitive scripts and mental representations of themselves. These IWMs shape children's attachment behavioral system. Children who are securely bonded with their parents, think of themselves as worthy of love and affection, which is important when forming relationships with others.

Despite Bowlby's mother-centric view on attachment, subsequent work has demonstrated that fathers can serve as important attachment figures for their young children (e.g., Lamb, 1997; Lamb & Stevenson, 1978; Parke & Tinsley, 1981). While this evidence base has been slowly emerging since the 1970s, more recent studies have continued to document how secure father–child attachments are important for healthy child development (see a recent special issue of *Attachment & Human Development* (2020) for a selection of these more recent findings).

Both the bioecological model and attachment theory are not necessarily focused on fathers, but when fathers are included in studies that use these frameworks, fathers are treated as mothers, that is, as caregivers. This is not the case in the models developed exclusively to understand fathers' behaviors. In these models, fathers are conceptualized as being involved (or not) in their children's lives. Involvement suggests that it could be optional and that is on a spectrum of more involvement to no involvement. Note that mothers are not considered to be involved. Mothers are always present.

A pivotal model in the fathering literature is Lamb et al.'s (1981) model that introduced the concept of "father involvement" through a tripartite model, consisting of fathers' level of engagement with their children (that is, direct interaction), degree of accessibility (i.e., availability to the child), and the extent of responsibility toward their children (i.e., managing their child's life; Lamb et al., 1981). This model was foundational in guiding the surge of fathering research at the time and has led to decades of research conceptualizing father-child relationships as these components of involvement. At the time when Lamb and colleagues introduced this model, much of the data on fathers were limited, mostly focused on measuring the frequency of father involvement, such as the amount of time fathers spent with their children. However, as more comprehensive conceptual models developed, research began to acknowledge the need for incorporating additional components of fathering, such as emotional support or the quality of father–child play, into empirical studies and theoretical models.

Palkovitz's (1997) model, for example, expanded conceptualization of men's caring behaviors toward his children. Palkovitz suggests an improved view of father involvement that includes three domains, cognitive, affective, and behavioral, that simultaneously function. He further identifies the multiple ways fathers may be involved with their child (e.g., communication, teaching, and shared activities and interests) that had not been included in measures of father involvement at the time. The model, however, does not hypothesize dynamic interactions or includes the role of the child in how they are parented. Moreover, despite the advances in more accurately conceptualizing father involvement, one of the main barriers to understanding how fathers matter for their children, which remains a barrier in contemporary research, is the lack of empirical data, in particular observational data. Observational methods provide rich data for studying the dynamics of relationships that is difficult to capture through survey methods. However, as the developments at the national level during the late 1990s resulted in new, national data on fathers and access to these data increased, research and theoretical models investigating fathers' impact on their children's lives expanded further.

In 2010, Pleck published a revised model of Lamb's and colleagues (1981) tripartite model, arguing that the early definitions of father involvement did not fully encompass the multiple

ways fathers might be involved with their children. Rather, he also placed a greater emphasis on the quality of father–child interactions and relationships to represent father involvement. Specifically, he included five components: (a) positive engagement activities, (b) warmth and responsiveness, (c) control, (d) social and material indirect care (i.e., purchasing goods and services for the child), and (e) process responsibility (i.e., father's monitoring that children's needs are met). This model provides a more comprehensive view of fathering that more accurately represents the ways in which research on this topic was expanding, but still neglected to acknowledge ecological and contextual variables that are important to consider in studies of families and parenting. The model, however, is not dynamic or accounts for children's influences on fathers' behaviors.

In 2014, Cabrera and colleagues published an expanded version of their ecological model of father–child relationships (see Fig. 19.1). This model does not exclude mothers and it is simply a heuristic model that can apply to the study of any caregiver. Drawing from ecological theory (Bronfenbrenner & Morris, 2006) and the process of parenting model (Belsky, 1984), this model focused on the ways in which contextual factors, including the environmental and psychological contexts, in which fathers' parent influence their children's development. In addition, this model theorizes the reciprocal influences between fathers and their children that are often neglected from other parenting models. By placing fathering within an ecological context, research can continue to expand by situating fathers in relationships that are embedded in the political, cultural, and social contexts that shape daily life.

Overall, there has been a concerted effort to develop theoretical frameworks to study fathers. Compared to the early 1980s, there are now many theoretical models that specifically include fathers that researchers can continue to empirically test. Moreover, many of these models incorporate the contextual factors theorized to influence parenting and ultimately children's development, providing a more accurate picture of the ecological context in which children are raised. To assist and guide this chapter, we utilized Cabrera et al. (2014) model to conceptualize the various ways in which fathers may influence their young children.

Fathers' Parenting and Infant Development

Infancy (0–1) is a period of wonder and growth. Healthy and normative development is marked by reaching developmental milestones or skills by a certain age. Children reach milestones in how they play, learn, speak, behave, and move (e.g., crawling, walking, or jumping). The first year of life is a period of tremendous growth and possibilities where babies learn to focus their vision, reach out, explore, and learn about the things that are around them. There is growth and change in all domains of development. Cognitive, or brain development includes learning processes of memory, language, thinking, and reasoning. During this stage, babies also are developing bonds of love and trust with their parents and others as part of social and emotional development. All these accomplishments are the result of complex and dynamic interaction between the child and their environments (Cabrera et al., 2014). The question is, what do we know about how fathers facilitate and promote the development of these milestones during the first year of life?

The empirical evidence on how fathering behaviors facilitate infant development are mostly based on small-scale observational studies that are homogeneous in terms of race and ethnicity and do not include diverse samples. This is an important consideration because different families experience different social, cultural, economic, and political forces that impact their development in specific ways (Bronfenbrenner, 1979). For example, how does parents' experience of racism and discrimination impact infant development? There is very little information on these types of issues. Below we discuss the empirical evidence by domain of development and point out whenever possible the demographic characteristics of the families included in these studies.

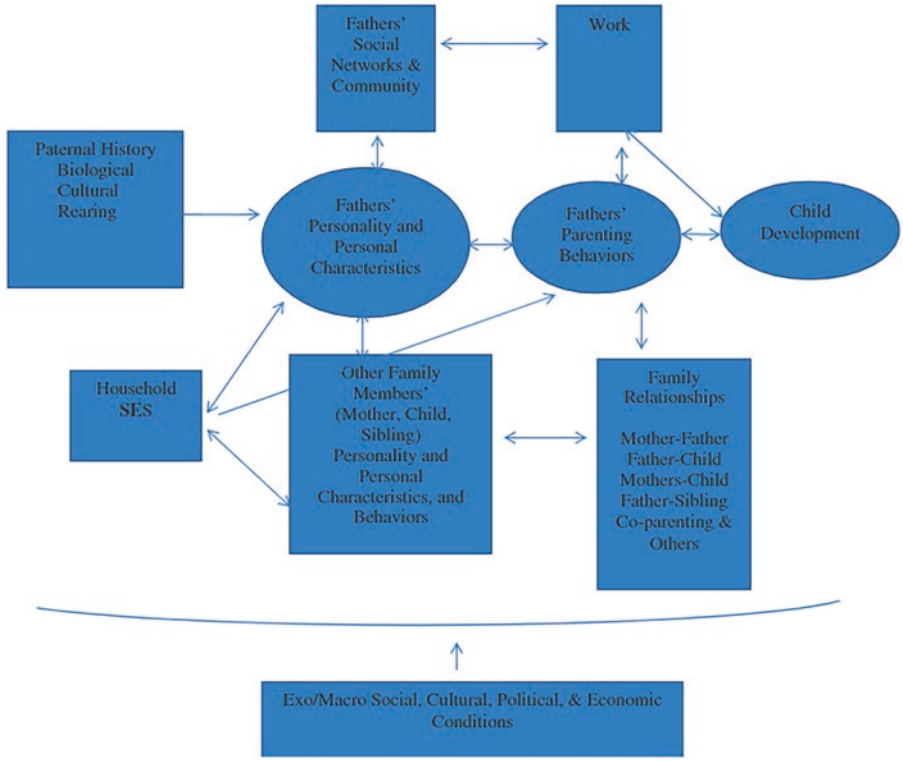

Fig. 19.1 The ecology of father–child relationships: an expanded model. (Note: Figure reproduced from Cabrera et al. (2014))

Social and Emotional Development

Through early relationships with nurturing and responsive parents, infants and toddlers learn to be social and to regulate their emotions. They learn to smile, make social connections with others, how to be in relationships, how to get their needs and wants met, and how to identify and regulate emotions. Social and emotional development includes behaviors that characterize children's emotional growth and their ability to successfully navigate their world through interactions with adults and others. Social–emotional milestones include children's developing abilities to regulate their attention, emotions, and behavior, and to form positive relationships with adults and peers. During this time, infants and toddlers develop a strong sense of self and build relationships with others at the same time.

What types of fathers' parenting behaviors are related to infants' social development? Earlier studies of fathering effects used attachment theory and found that children who were observed to have a secure attachment to their fathers exhibited better social and emotional adjustment than children who had insecure attachment (Diener et al., 2002; Dumont & Paquette, 2013; Volling et al., 2006).

Several studies have focused on fathers' presence in the home or father contact as a predictor of children's adaptation. Although this way of conceptualizing father involvement is no longer favored because it provides little information about how fathers are engaged with their children, it can be seen as a proxy for engagement. Fathers who are present in the home are de facto available to and engaged with their children in daily activities (Bocknek et al., 2014). Choi and Jackson (2011) and Bocknek et al. (2014) found that when fathers were present and had more frequent contact with their children, children were reported as exhibiting less aggression. Father

absence, especially when it is voluntary, seems to impact children most negatively. Using data from early waves of the FFS, researchers found that children had increased aggressive behaviors when they had fathers who were incarcerated. Incarceration had stronger effects on children's behavior compared to other types of father absence (e.g., death). The effects of paternal incarceration were stronger for those young children who had lived with their fathers prior to their incarceration compared to those who had never lived with their father.

Fathers who use positive disciplinary practices tend to have children with better outcomes than fathers who use harsh discipline. In a socioeconomically diverse sample of 136 fathers, Burbach et al. (2004) found that the frequent use of corporal and verbal punishment was significantly, and directly, related to child behavior problems where children ranged in age from 1- to 5-years-old. In another study that used a subsample of residential fathers from the FFS, Lee et al. (2011) found that children's aggressive behavior increased in tandem with fathers' aggressive behavior, even after controlling for fathers aggressive and nonaggressive discipline strategies (Lee et al., 2011). Although not extensive, but consistent with a vast literature, this evidence suggest that the use of harsh discipline is not only ineffective at curbing children's negative behavior, but it could also be harmful with long-term consequences.

Other studies have investigated the impact that father engagement in learning activities has on children's social development. Evidence using national data show that fathers who are involved in play and caregiving have children who exhibit fewer problem behaviors than fathers who are less engaged (Baker, 2014; Bocknek et al., 2017; Lang et al., 2014; Levant et al., 2014; McMunn et al., 2017). Using a subsample of African American and Caucasian children from the ECLS-B, Baker (2014) found that fathers' reports of more frequent home literacy activities (e.g., reading) were positively related to their children's increased attention and negatively related to negative behavior when children were 24 months old. Similarly, a study using the FFS data, Choi et al. (2018) found that unmarried fathers' involvement (measured as the frequency of fathers engaging in caregiving tasks) significantly predicted child behavior problems when they were 1, 3, and 5 years old.

Previous literature has measured the quality of the father–child relationship using a variety of constructs including nurturance, supportiveness, warmth, sensitivity, emotion talk, verbal responsiveness, intrusiveness, restrictiveness, and control . Many of these studies use observational data. Largely, this research found that increased positive parenting (often measured as sensitivity or dyadic mutuality) predicted better social and emotional outcomes in their children (Kochanska et al., 2008, 2015). As expected, observations of fathers who exhibited negative parenting behaviors, often measured as intrusiveness or disengagement, predicted poorer social and emotional outcomes in their children (Cabrera et al., 2007; Kelley et al., 1998; McHarg et al., 2019; Nam & Beyer, 2016; Ramchandani et al., 2013).

Given that play is a key developmental context for children with rich opportunities for social and emotional learning, several studies have sought to understand the nature of play between children and their fathers. Using a low-income sample, Cabrera et al. (2007) found that while maternal intrusiveness during play was negatively associated with toddlers' emotion regulation at 24 months and pre-Kindergarten, fathers' intrusiveness did not have a significant effect. These findings suggest that mothers and fathers' interactions with their children are dyadic specific and, therefore, affect children differently. A recent systematic review of father-child play during the early years of life found that fathers spend a substantial portion of their time engaging in playful interactions, often in the form of rough and tumble play. The findings that were reviewed in this study suggested that by and large, fathers' play during the earliest years of life positively contributed to children's social, emotional, and cognitive outcomes (Amodia-Bidakowska et al., 2020).

Relatively a fewer studies have focused on why positive or increased father involvement is beneficial for children's development. In one

study that used the ECLS-B, researchers found that increased father engagement (i.e., the frequency of reading, telling stories, or singing songs) acted as a protective factor between family risks (measured as poverty) and children's social behaviors (e.g., internalizing problems; Cabrera et al., 2011). In another study that used a subsample of over 700 toddlers from the Early Head Start Research and Evaluation Project, Bockneck and colleagues (2017) found that children who were rated as having high emotional reactivity benefitted the most from engaging in moderate amounts of active play with their fathers; however, children whose fathers reported very low or very high amounts of active play had poorer outcomes.

In summary, fathers have a positive influence on infants' and toddlers' social and emotional development when they engage in frequent, sensitive, and warm interactions with their children. Across the various ways of father involvement (e.g., father presence, frequency of caregiving, and quality of support), fathers play an important role in the prevention of young children's negative behaviors. However, most of these studies focused on internalizing and externalizing behavior problems, and aggression. Only a couple of studies focused on emotional regulation or other positive aspects of social development such as social competence. This is an important future direction for researchers.

Language Development

The development of language and the ability to communicate are arguably the most significant developmental milestones. The first 3 years of life, when the brain is developing and maturing, is the most intensive period for acquiring speech and language skills. These skills develop best in an environment that is rich with sounds, sights, and consistent exposure to the speech and language of others. Parents and caregiver are urged to take advantage of critical periods for speech and language development when the brain is best able to absorb language and form neural connections that support language and communication skills. Infants learn that they can communicate a need for food, comfort, and companionship with a cry. Newborns also begin to recognize the voice of their mother or primary caretaker and eventually begin to sort out the speech sounds that compose the words of their language. By 6 months of age, most babies recognize the basic sounds of their native language. Although children vary in their development of speech and language skills, they follow a natural timetable for mastering the skills of language.

Given the importance in language skills, it is not surprising that scholars have steadily focused on understanding fathers' role. Studies have found that fathers who are engaged in a variety of activities with their child have children with better language skills than fathers who do not (Choi & Jackson, 2012; Duursma, 2016; Lankinen et al., 2018). As expected, fathers who read more to their children have children with better vocabulary than those who read less frequently (Duursma, 2014). However, Duursma et al. (2008) found that paternal book reading frequency only predicted children's language skills when fathers had at least a high school education.

Others have focused on the quality of parents' speech during observed interactions between children and their fathers. These studies show that the quality of parents' speech during parent–child interactions, often measured as complexity, is predictive of children's language development (Duursma, 2016; Leech et al., 2013; Malin et al., 2014; Rowe et al., 2017; Salo et al., 2016; Schwab et al., 2018; Teufl et al., 2019). Many of the studies examining the quality of father speech as it relates to children's language utilize various subsamples of the Early Head Start Research and Evaluation Project. It would be important for future research to utilize other samples to replicate these findings. When scholars have shifted their attention to examine differences in the quality speech used between mothers and fathers during interactions, they found that fathers use more complex speech compared to mothers, which had a unique effect on children's language (Bingham et al., 2013; Pancsofar & Vernon-Feagans, 2006).

Other scholars have examined the role of parenting quality (i.e., sensitivity, supportiveness), more generally, observed during parent–child interactions in children's language development. In one of the first empirical studies to use observational data, Black et al. (1999) found that African-American fathers who were more nurturant during play had children with better language skills than fathers who were less nurturant. Cabrera et al. (2007) using an ethnically diverse sample of data drawn from the EHS study reported a similar finding. Fathers who were more supportive during play had children with better language skills than less supportive fathers; however, they found the opposite was true when fathers exhibited intrusive behaviors during play. In a small-scale study, Malmberg et al. (2016) found that fathers' observed sensitivity predicted children's language skills, but they also found that compared to maternal sensitivity, paternal sensitivity had a stronger effect on their children's language abilities.

Overall, these studies indicate that fathers' influence their children's language development by spending time with them engaged in different activities or by engaging in literacy activities such as reading, singing, telling stories. However, beyond just the amount of time fathers are with their children, there is a small but convincing body of work indicating that the quality of father–child speech, in addition to being a sensitive/responsive caregiver, influences children's language skills. These studies also suggest that fathers' impact on children's language development is over and above the contribution of mothers.' In other words, fathers are not the same as mothers and their involvement in their infants' lives should be encouraged and promoted in its own right.

Cognitive Development

Infants' and toddlers' thinking skills develop and get more sophisticated over time as they interact with the world and people around them. The key to cognitive and healthy brain development is through consistent, nurturing, and responsive interactions and care and by exposing children to rich and diverse experiences. As infants and toddlers cognitively develop, they begin to understand and predict how things work (e.g., they open and close a cabinet door over and over, they fill and dump a cup of water in the water table, they bang a spoon on a highchair to hear the sound). Fathers help their children achieve these milestones by frequently engaging in different types of activities (Bocknek et al., 2017; Bronte-Tinkew et al., 2008; Duursma et al., 2008). However, the story of how fathers promote cognitive development is not clear as some studies have found that the frequency of fathering was not related to better cognitive outcomes (Cabrera et al., 2006; Rosman & Yoshikawa, 2001). These mixed findings are in part explained by the fact that studies that found significant associations only included fathers in their analyses, whereas studies that did not find statistical support controlled for the effects of mothers while testing the association between father involvement and infants' cognitive abilities. Moreover, although all these studies used relatively large sample sizes (that is, greater than 700 participants), the studies were not consistent in their use of cognitive tests. Studies that found significant results measured general cognitive skills via the Bayley Scales of Infant Development whereas the study that that did not find statistical support utilized a different measure of cognitive ability (Rosman & Yoshikawa, 2001). These mixed findings suggest that future research should use consistent measures to draw more conclusive statements about the specific influence of fathers on their young children's cognitive skills.

As with other domains of development, the mechanisms that might explain why the frequency of fathering matters for children's cognitive development is not well understood. There is some evidence that a potential mechanism is maternal behaviors. Using the ECLS-B, Cabrera et al. (2011) tested the effects of parental risk on their children's development. They found that fathers who were more at risk (i.e., being a teen parent, low education, unemployment) were indirectly related to children's general cognitive skills, as measured by the Bayley Scales of Infant

Development, through observed maternal sensitivity. Father involvement also may be more important for children who have some risks. Using the FFS, Fagan and Yookyong (2012) found that the relationship between fathers' frequency of cognitive stimulation (i.e., frequency of reading books, singing songs, and telling stories) and children's cognitive skills was stronger for children who had more risks (i.e., physical health, disability, premature birth) and who lived in single-headed households. And increased father involvement might be protective against mothers' insensitive behaviors. In a small-scale study of Latina mothers and their children, Grau et al. (2015) found that mothers who were less acculturated and used more directiveness during play had children with larger gains in their cognitive development skills, only when father engagement was high.

Why does parenting quality matter for cognitive development? We found only two studies that have done so. In these studies, fathers' parenting quality had a unique and stronger effect on children's cognitive development compared to mothers' parenting quality (Malmberg et al., 2016; Owen et al., 2013). Taken together, these findings suggest that there is a wide variety of constructs that are used as a measure of parenting quality, both positive and negative, but a few studies examine parenting quality as a mediator between parenting and children's cognitive skills.

Overall, these studies indicate that fathers influence their children's cognitive development through their frequency of involvement, in addition to engaging in high-quality interactions with their children. However, more work is needed to unpack the potential mechanisms that might explain the relationship between father involvement and children's cognitive development.

Pre-Academic Skills

Pre-academic skills are a part of children's cognitive development and include early literacy (e.g., understanding of books and simple stories, beginning phonemic awareness, and recognizing familiar logos and signs), math (understanding letters and numbers, colors, shapers, matching, sorting), and science (observing, asking questions about cause and effect), and pre-writing (scribbling, imitate drawing a line down, a line across, circles). Research shows that young children who develop these skills are ready for school (school readiness) and have better chances of succeeding later on at school. Pre-academic skills help the child best when the child is also ready emotionally and physically to be in a school setting.

Studies have shown that fathers and mothers who provided frequent literacy support at home had children with better reading and math scores later on (Duursma, 2014; Sims & Coley, 2016). Reynolds et al. (2018) found that fathers' language complexity and use of *wh*-questions (such as, who, why, what, where, when) during toddlerhood predicted children's math scores once they entered school. Using *wh*-questions, a challenging quality of the communicative input, requires that children articulate words and provide a more detailed response that can promote verbal reasoning skills. Using the ECLSB, Cabrera and colleagues (2020) found the effects of fathers' early cognitive stimulation (reading, singing) on early reading and math skills at 48 and 60 months. Using the same dataset, Baker (2017) found that paternal warmth had the strongest effect on boys' reading skills for families who were living above the poverty line. These findings add a voice to the chorus of findings that fathers who engage with their children in literacy skills and are warm and supportive have children who are better ready to succeed in school.

Physical Development

Infants are born to explore the world around them. Infant and toddler physical development occurs rapidly over the first years of a child's life. In one short year, infants progress from having a difficult time holding up their heads to starting to walk. As with other domains of development, responsive care from loving caregivers, adequate nutrition, and timely and stimulating environments support physical development. Parents

who understand the various stages of infant and toddler physical development are best able to respond to children's needs appropriately. Although physical development occurs at different times for all children depending on many factors, such as a child's unique characteristics, the family's values and culture, and access to available resources, caregivers play a big role.

Unlike other domains of development, there is not a lot of information on how fathers promote young children's healthy physical development. Some studies that have focused on this topic have measured father involvement as the frequency of father contact, hence, the specific activities that fathers do to support healthy physical development are unclear. In a study of Peruvian children, Dearden et al. (2013) found that children who did not have regular contact with their fathers during infancy or childhood had significantly lower standardized height-to-weight scores compared to children who saw their fathers on a daily or weekly basis, even after controlling for family wealth, marital status, housing quality, and maternal education. In another study with children in the United States, Jackson et al. (2016) found that children whose fathers were not present during their birth were at greater risk for being diagnosed with a developmental disorder; however, there was no statistical evidence to suggest that low paternal involvement, reported by fathers, before or after birth increased the risk of a child being diagnosed with a developmental disorder by age 4. However, Tracey and Polachek (2018) found that non-resident fathers who spent an extra day per month of time with their children were more likely to have children with better health, including physical. There appears to be mixed evidence to suggest that the frequency of fathering influences an array of children's physical development outcomes.

Other studies have focused on the observed quality of interaction between fathers and their children as it relates to their children's physical development. Millikovsky-Ayalon et al. (2015) examined children's sleep patterns and found that fathers were overall less sensitive during a feeding interaction and were less involved in childrearing than mothers. However, the negative effect of children with sleep disturbances on parental stress was reduced when fathers reported being highly engaged with their children. In another study that examined fathers' mindfulness parenting, Zeegers et al. (2018) found that fathers' observed mind–mindedness comments (e.g., comments about the child's internal states and feelings) had a soothing effect on infants (stabilize heart rate) because they were observed to be more responsive and warmer with their children.

One important body of research that links fathering and children's physical development focuses on activation relationship theory (see Chap. 18 of this volume). Stemming from attachment theory, activation relationship theory suggests fathers are more likely than mothers to play with their children in a way that creates a heightened state of arousal or excitement in the child. In contrast, mothers tend to favor quieter and more nurturing styles of play than fathers. This, of course, does not mean that mothers do not "activate" their children and that fathers are not nurturing. Theoretically, this "activation" is expected to occur more often in father–child interactions. Studies with French-Canadian low-income families have found paternal activation to be linked to children's regulatory skills and ability to take risks to explore their physical world (Paquette, 2004). However, Paquette and colleagues have found that this style of play benefits children only when they have secure attachments to their father. The father–child activation relationship enables the child to feel stimulated, overcome limits, and take chances in contexts where the child feels confident and safe by having the presence of their secure base (i.e., their father). Within the context of this father–child activation relationship, children can develop the confidence to face the outside world, which is a key element of socialization. Other researchers interested in exploring how father play is different from mothers' play have also investigated associations between rough-and-tumble play and challenging parenting behaviors (CPB) and report similar findings. The type of play interactions by engaged fathers (or mothers) that challenges children and pushes them out of their comfort zone has been related to

decreased aggression (Flanders et al., 2009) and reduced anxiety (Majdandžić et al., 2016).

In summary, studies that examine the influence of father involvement on children's physical development are few. The small number of studies to test these associations has found that father engagement is protective for young children's physical development, but that the quality of their engagement with their children also plays an important role in specific aspects of physical development such as sleep.

Individual and Family Influences on Fathering and Infant Development

An important question that preoccupies fatherhood researchers is why are some fathers more involved in their children's lives than others? What are the conditions or circumstances that are related to the quality of fathers' interactions with their children? The answer to these questions has policy and programmatic implications. As we have shown in the earlier part of this chapter, father engagement and healthy interactions with their children are key to the healthy development of children and thus fathers need to be supported in their roles. Understanding what are the barriers to involvement can help us understand how best promote healthy father involvement. According to the Ecology of Relationships Model (Cabrera et al., 2014), fathers' parenting behaviors are conditioned on specific aspects of their personalities, history, cultural background, family, and other aspects of the environment in which they rear their children. In this section, we discuss a few key contextual factors that have been studied to understand fathers' variability. This is not an exhaustive list as many factors (e.g., racism, discrimination, cultural beliefs and values, political conflict, etc.) that impact fathering behaviors and consequently the wellbeing of their children have not been investigated thus far. These are areas where urgent research is needed. A caveat is in order. The studies that we describe below are mostly atheoretical include small sample sizes and are not racially or ethnically diverse. Moreover, many of these studies do not describe the samples' sociodemographic characteristics making it difficult to understand to what subpopulations these findings represent.

Depressive Symptoms

Parental depression is one of the most risk factors for poor child outcomes because it shapes not only a parent's perception of the world but also a child's experience of the world internally and externally. Parental depression can interfere with bonding and nurturing as well as safety and health, which are central to healthy child development. Some studies have found that depressed mothers use less emotion and expressivity in their language with their babies, make less eye contact, and are generally not likely to engage in fun activities such as reading in a joyful and engaged manner. Another concern is isolation of the parent and child which can limit the social networks of both the adults and the child. Two issues of consideration in the studies on parental depression: most of them do not distinguish depressive symptoms from clinical levels of depression and, not surprisingly, most of them focus on mothers.

The few studies that have examined the effects of paternal depression on children's outcomes use the Centers for Epidemiological Studies-Depression Scale (CES-D), a self-report measure. The majority of the studies on paternal depression, which were primarily with highly educated and middle-income large samples, found that either paternal depressive symptoms alone or maternal and paternal depressive symptoms in combination were related to children's internalizing and externalizing symptoms (Carro et al., 1993; Nath et al., 2016). For example, in a highly educated sample of married couples, Carro et al. (1993) found that maternal, but not paternal, depressive symptoms predicted children's problem behaviors. Using a representative sample of young children from the ECLSB, two studies examined the influence of paternal depression on children's cognitive skills. Cabrera et al. (2006) found that maternal, but not paternal, depressive

symptoms predicted 9-month-old infants' scores on the Bayley Scales of Infant Development; however, Cheng et al. (2016) found that fathers', but not mothers', depressive symptoms predicted lower Bayley scores when children were 24 months old. A small-scale, a study of 128 families supports this finding. Sethna et al. (2017) found that fathers who were more withdrawn and demonstrated depressive behaviors while interacting with their infants had children with lower Bayley scores by 25 months. These studies indicate that children's development may be influenced differently by their fathers' and mothers' depressive symptoms and that these effects are conditioned on children's age.

Parenting Stress

A voluminous literature has shown that parental stress—the stress parents feel in connection to rearing their children—is a powerful risk factor for adverse child outcomes, including the development of aggression, externalizing behavior problems, and anxiety, as well as reduced emotional coping, and diminished social cognition. Again, as you have read repeatedly in this chapter, the empirical evidence on how fathers' parenting stress impacts their parenting is limited.

A handful of studies examining fathers' parenting show a similar pattern of effects to mothers. Using a subsample of children from the Early Head Start Research and Evaluation Project (EHSREP), Vallotton et al. (2016) tested the effects of both fathers' parenting stress and depressive symptoms on parents' ratings of their children's behavior problems. They found that parenting stress had a stronger effect than depressive symptoms. Also using a subsample of children from the EHSREP, Harewood et al. (2017) found that fathers who reported more parenting stress had children with lower cognitive scores (as measured by the Bayley Mental Development Index).

Although the mechanisms through which it operates are not well understood, there is some evidence pointing to specific parenting behaviors. Mitchell and Cabrera (2009) found that in a sample of primarily African-American fathers, parenting stress was indirectly related to children's problem behaviors through fathers' engagement in child management tasks (i.e., taking the child to the doctor). Further, Lee et al. (2018) examined the effect of parenting stress on children's internalizing symptoms across family structures, using a subsample of fathers participating in the Building Strong Families (BSF) evaluation. They found that for unmarried, nonresidential father families, fathers' parenting stress was associated with children's internalizing symptoms. For consistently cohabitating and residential father families, this effect was marginally significant. For married families, these relationships were not significant. Also using data from BSF, Ward and Lee (2020) examined whether observed parental responsiveness mediated the relationship between parenting stress and young children's receptive language (measured via the Peabody Picture Vocabulary Test) and child prosocial behavior (measured via mother report on the Social Interaction scale of the Preschool and Kindergarten Behavior Scales). They found that for both mothers and fathers, parenting stress was indirectly associated to cognitive development and prosocial behavior at 36 months due to its influence on parental responsiveness. These studies underscore two important findings: parenting stress is an important aspect of being a parent and, therefore, should be studied in fathers. Parenting a child is difficult and stressful for everyone, including fathers. Second, parenting stress appears to disrupt specific aspects of parenting and so its impacts on children might not be readily apparent.

In summary, there is still little information on the influence of fathers' mental health on their parenting behaviors and children's wellbeing. We found no studies of fathers who experienced positive mental health or psychological functioning as it relates to their children's development. This is an area of much needed research.

Alcoholism

According to a report by the Substance Abuse and Mental Health Services Administration (SAMHSA), about 1 in 8, or 8.7 million, children ages 17 and younger live in a house with a parent who has a substance-abuse disorder within the last year (Lipari & Van Horn, 2017). Parents' alcohol consumption can impact children from the moment of conception**.** One study found that babies whose fathers consume excessive amounts of alcohol prior to conception may experience deficits in brain development (Conner et al., 2020). Consequences of alcohol abuse in a family have been documented throughout a child's development—especially socially, emotionally, and cognitively.

Evidence from longitudinal studies show deleterious effects of alcoholism on parenting and child wellbeing. While Leonard and Das Eiden (2002) did not find any differences in children's general cognitive development (as measured by the Bayley) nor their language development, who had alcoholic or non-alcoholic parents, Eiden et al. (2004) found that boys who had alcoholic fathers had overall lower levels of effortful control (measured via a battery of direct assessments including snack delay and gift delay tasks) compared to boys with non-alcoholic fathers. In addition, boys in the Michigan Longitudinal Study of family risk for alcoholism and co-morbid psychopathology whose fathers experienced alcoholism and antisocial personality disorder, compared to boys whose fathers did not, had deficits in cognitive, social, emotional development and behavior regulation that persisted from preschool through adolescence and into adulthood (Hare et al., 2023; Noll et al., 1992).

Family Relationships

According to the Ecological Relationship Model (Cabrera et al., 2014), fathering is embedded in a network of relationships with direct and indirect influences on fathering. The majority of studies examining how family processes affect fathers have focused on interparent conflict and coparenting relationships (see Chap. 21 of this volume).

In a study of middle-class parents. Stevenson et al. (2019) found that when parents reported more relationship conflict, children had higher externalizing problems. In a later study, Volling and colleagues focused on the role of interparental conflict in children, accounting for the role of the child's sibling. Further, Volling et al. (2006) found that when parents reported high relationship conflict, fathers were less likely to exhibit shared positive affect and older siblings were less likely to comply with commands.

Another key aspect of family functioning that has a significant impact on fathers' parenting is coparenting or the ability to work together as a couple to rear children. Using Feinberg's (2003) model of coparenting, Cabrera et al. (2009) found differences in the effects of coparenting conflict on fathers' engagement in caregiving by fathers' level of acculturation (measured by English proficiency). Specifically, they found that when coparenting conflict was high, more acculturated fathers engaged in more frequent caregiving behaviors with their infants compared to less acculturated fathers.

In a series of studies using FFS, Choi and Jackson (2011, 2012) examined the indirect effects of African-American non-residential fathers' parenting on children's behavior problems, predicted by economic hardship, maternal depressive symptoms and the quality of the mother–father co-parenting relationship (measured via the Multi-Dimensional Support Scale). One study (Choi & Jackson, 2012) found a modest significant indirect effect of the frequency of fathers' parenting activities (e.g., how often they read books to their child) on children's scores on the Peabody Picture Vocabulary Test and scores on the Child Behavior Checklist (CBCL) when mediated through mothers' self-efficacy and frequency of parenting activities. Similarly, Choi and Jackson (2011) also found a modest significant indirect and protective effect of non-residential fathers' frequency of parenting activities on children's problem behaviors at age 3, mediated through mothers' parenting activities. Using a different measure of coparenting

behavior reported (i.e., Parenting Alliance Inventory), researchers did not find a direct association between co-parenting quality and child behavior problems (measured using the CBCL) in a sample of low-income resident and non-residential fathers and their 2-year-old children (Mack & Gee, 2018). However, they found that higher reported co-parenting quality was associated with lower levels of internalizing behaviors for girls, but not boys.

There has also been a strong interest in testing interventions on coparenting and child outcomes. One of these interventions focused on improving coparenting between parents, which resulted in an increased couple relationship quality and increased father engagement (Cowan et al., 2009; Rempel et al., 2017). In a follow-up study, Cowan et al. (2009) found that compared to a control group who received a one-time information meeting, families who participated in the 16-week program had positive effects on fathers' engagement with their children and children's behavior problems. They also found that those who participated in the intervention as a couple had more consistent, longer term positive effects than the fathers who participated in the intervention without a partner. These studies point to coparenting as a key family process that can improve the entire family system and underscore the importance of intervening with the entire family. So many of our interventions focused on the mother–dyad relationship, which cannot be as effective as if mothers, fathers, and their children were included. The story of how coparenting influences on fathering and children's outcomes is not cohesive yet, but these are encouraging findings that point in fruitful directions.

Not surprisingly, studies that include other family members are even more sparse. There are a couple of studies that stand out because they included grandmothers. In a sample of Latino families, Grau et al. (2015) examined the role of both father and maternal grandmother engagement on children's developmental skills. They found significant compensatory (or buffering) effects of father involvement and grandmother involvement on the quality of mothers' interactions and children's language and cognitive skills. Specifically, mothers who were less acculturated and had more directiveness towards their child during play had children with higher gains in cognitive skills only when father engagement was also high. Additionally, mothers who were more acculturated and had more positive affect during interactions with their child had children with more gains in expressive language, when grandmother engagement was also high. However, in a sample of white, African-American, and Latina families, Rosman and Yoshikawa (2001) did not find support that father nor grandmother involvement predicted children's outcomes. These mixed results may be due to differences in cultural expectations around extended family engagement. All in all, the limited number of studies examining additional family members roles in tandem with father involvement as it relates to child development point to this being an important area for future work.

Overall, there are a few studies that take a systematic view of how parents' context and circumstances, especially in terms of family processes, influence fathering behaviors. The limited attention placed on parents' relationship quality and the quality of the coparenting relationship is a major gap in this literature.

Fathers' Financial Resources

Indisputably, fathers' ability to financially support their children is a critical aspect of parenting. Despite the importance of financial support (Cabrera et al., 2014), a few studies have tested influence of fathers' financial resources on infant development (there is a vast economic and sociological literature on the effects of household income on older children's development). The majority of the available studies that have examined fathers' financial resources and infant development are framed within ecological theory (Bronfenbrenner, 1979; Bronfenbrenner & Morris, 2006) and primarily draw from large datasets, focus on low-incomes and low educational attainment samples, and have a mix of cross-sectional and longitudinal study designs.

Overall, fathers' financial contributions have been found indirectly associated with children's behavior problems through mothers' mental health (i.e., depression and stress) and mothers' parenting (Choi & Pyun, 2014; Choi et al., 2014; Jackson et al., 2013, 2015). These studies indicate financial support is important because it improves one key aspect of the home environment: maternal parenting. When mothers experience less economic stress or feel supported by their child's father, they are more likely to engage in activities promotive of children's language development. A study by Padilla and Reichman (2001) explored the role of fathers' monetary support on infant birthweight. They found a significant, negative effect of mothers' receiving monetary support from the baby's father on the likelihood of giving birth to a low birthweight baby. Several of these studies utilized the data from the FFS and all of these studies relied on mothers' reports on fathers' financial contributions. Therefore, there is still less known about how fathers' perceptions of their own parenting or reports of their formal or informal financial support directly or indirectly reach their children.

Summary and Key Points

In this chapter, we reviewed the evidence published over the last three or so decades that set out to examine the influence of fathers on several areas of their young children's development. Overall, the evidence presented in this chapter shows that fathers influence their infants and young children in several ways. First, fathers have direct influences on multiple domains of their children's development through their frequency of involvement and by engaging in high quality, warm, and sensitive interactions with their young children. Second, fathers' mental health has a key influence on children's development. Specifically, fathers' depressive symptoms and parenting stress have a negative influence on child outcomes, suggesting that the identifying and preventing poor mental health in fathers may be particularly important for infant wellbeing. Third, although the evidence is limited, the quality of the interparental relationship and coparenting relationship are key influences on fathers' parenting and ultimately children's development. Fourth, financial resources particularly of nonresident fathers influence infant development, conducted only with nonresident fathers, fathers' financial resources also have an indirect effect on their children through mothers' parenting behaviors. Fifth, fathers' parenting has a significant and unique effect on their children, over and above the effects of mothers' parenting.

Despite the tremendous growth in research on fathers, particularly within the last 10 years, there are many ways this literature remains limited. First, much of this literature focuses on the impact of father involvement on children's social and emotional and language development, there is limited research on children's emerging preacademic skills and physical and health development. Second, there a very limited literature exploring fathers' mental health, family relationships, and financial contributions as it relates to infants' outcomes. In particular, there were very few studies that examined the characteristics of mothers' and fathers' relationships as it related to parenting and infant development. There is growing research documenting the importance of parents' relationship quality and having a high-quality coparenting relationship on parenting. Therefore, future research should also focus on linking family processes to areas of children's development, particularly as these are factors often targeted by programs and policymakers.

Third, another major limitation of this literature is that by and large, studies do not include a theoretical framework to guide their work, suggesting that much of this literature is not working towards building theory or providing evidence that can inform interventions. Of the studies that included a theory, many used different theoretical frameworks, making it difficult to compare across studies. There is still not a unified theoretical framework that researchers use in their work. This is problematic as theory building is central to the scientific process and those studies that lack a theoretical framework may be more prone to bias.

Fourth, with a number of exceptions, most of the studies described in this chapter are based on small-scale studies in the United States, have low- to middle-income samples, and have samples of parents with high educational attainment or a range of education levels. That is, over the last three decades the research on fathers has not diversified to include a wider range of fathering groups, cultural values or beliefs, or experiences. Researchers have made attempts to include socioeconomically diverse families, but these studies need to be replicated and conducted with different SES within ethnic groups. Moreover, most of this work remains deficit oriented and has almost completely ignored a critical aspect of rearing children in the United States: systemic and structural racism and discrimination. A glaring finding is that there are virtually no studies of middle-class Black or Latin families just as there are almost no studies of low-income White families. Importantly, although the majority of studies did not include racially and ethnically diverse samples, most studies had at least some participants who identified themselves as an ethnic minority, suggesting that there is less research that looks across racial/ethnic groups. This makes it difficult with the evidence we have now to draw conclusions about culturally specific family processes that fathers may utilize to socialize their children and help them to develop key skills. This is a huge disparity in our science. There is almost no information about the normative developmental trajectories of non-White fathers and their infants. Despite this limitation, it is promising that more studies with diverse samples are expanding into this field of research.

Relatedly, most of the studies on fathers and child development included mostly residential fathers, with a smaller number of studies including both residential and non-residential fathers. A very few studies included only non-residential father samples. Consequently, we still know little about how non-residential fathers specifically are contributing to various domains of their children's development. The dearth of studies that focused on non-residential fathers may be due to our explicit focus on reviewing studies for this chapter that included a child outcome as a dependent variable. Although we did not include studies of nonresident fathers that did not have child outcome information so we cannot draw a definitive conclusion, we expect that many of the studies with exclusively non-residential father samples examined only the factors that predicted father involvement or fathering behaviors. While this subpopulation may be more difficult to study when examining links between fathers and child development due to child custody arrangements or complex family dynamics, many children who primarily reside in single-headed households, do have contact with their non-resident fathers (Fagan, 2023). Therefore, additional work that examines these relationships in this population would add greatly to this field.

Fifth, studies included in this review primarily included reports by both mothers and fathers. While this may reflect our inclusion criteria for this chapter that a father-level variable had to be a main independent variable, it was surprising that more of the literature did not rely on mothers' reports on fathers given the challenges that are often cited with recruiting and retaining fathers in child development research. Similarly, it was surprising that so many of the studies included in this chapter were longitudinal and followed mothers, fathers, and their children over time, due to the time-consuming and costly nature of these types of studies. However, while there was a substantial number of longitudinal studies, there was a small number of studies that tested for the indirect effects of fathering on children's development. As longitudinal study designs are often necessary to test for these types of effects, it was puzzling that more studies did not test for these relationships. Researchers who take the time and effort to collect these longitudinal samples may not be adequately taking advantage of these data. Studies that examine mechanisms—indirect or moderating effects—are sorely missing. These studies are particularly important when attempting to inform programs and policy as to the most targeted points of intervention or those specific mechanisms that could be leveraged to improve fathers' parenting and the lives of young children.

Finally, although most studies included reports by both mothers and fathers, studies rarely tested for unique or independent effects between mothers and fathers or joint effects. Therefore, less is still known about what fathers are specifically doing that either compliments or adds to mothers' positive parenting practices or what they do that may buffer against or compensate for mothers' parenting that may be maladaptive. As stated above, this research may be underutilizing those data that are being collected to understand the true ecological nature of the family. Additional work could better utilize these data with the appropriate methods to test for these relationships. Without this knowledge about fathers' unique effects, it makes developing targeted policies and programs that aim to include and build on the strengths of fathers' challenging.

Conclusions

Despite the limitations of the research on fathers, there is encouraging evidence that fathers play a central role in the development of their young children. Highlighted by the increasing number of publications on this topic, researchers are continuing to expand the empirical evidence on how fathers influence their young children. More research is needed to parse out the potential unique effects of fathers, particularly certain subpopulations of fathers, and to grow the literature base on children's specific cognitive processes, physical development, and early academic skills. All in all, there is sufficient evidence to urge both policymakers and professionals to work to improve the circumstances for fathers to be active, involved participants in their children's lives.

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Coparenting Theory, Research, and Practice: Toward a Universal Infant–Family Mental Health Paradigm

James P. McHale, Erica E. Coates, Russia Collins, and Vicky Phares

Over the past 30 years, the field of child development, in general, and the field of infant–family mental health have seen substantial theoretical and empirical evolution and advances in the conceptualization of a phenomenon known as coparenting. Coparenting is a conceptual framework that connects clinical understandings from the field of structural family therapy to the expansive knowledge base on the socioemotional adjustment of children within the relationship systems that channel their development. Initially stimulated by studies of post-divorce coordination and conflict between parents—and the impact of coparental functioning on the successful or problematic adaptation of the children of divorce—developmentally oriented researchers began investigating coordination, cooperation, and communication between parents who were *not* divorced. Such studies initially engaged mothers and fathers raising young children in married, coresidential life circumstances, and gradually expanded to examine parallel dynamics in a variety of other family systems, including those led by unmarried non-coresidential biological parents, stepfamilies, multi-generational families, and many of the other family systems worldwide that are configured to protect children and help them flourish (McHale, 2007a).

As the field evolved, conversations about how to operationalize family and coparenting processes began to draw upon a seminal, broad-based, and inclusive definition—coparenting understood as the mutual, shared efforts by the two or more adults who assumed responsibility for children's socialization, care, and upbringing (McHale et al., 2002). This all-encompassing description is a universal, "every child" concept, recognizing and honoring each child's experiences in their own unique family structure and life circumstance. It accommodates global, cross-national cultural accents regarding the division of childcare labor, gendered, or disparate engagement of different coparents in varied developmental tasks, complementarity in styles of different coparents, and other socially rooted adaptations. And above all, it elevates and accentuates the essential, *child-centered* focus of coparenting structure and function in any family system.

This chapter centers on the field's most important themes and topics so infant mental health professionals can make use of its amassing

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knowledge base. It is divided into four sections. First, it provides a summary and overview of major concepts and issues in the field of coparenting, spotlighting the innovative lens the coparenting model has brought to traditional infant mental health work. As scores of cogent publications have covered these same issues since the field's origins in the mid-1990s, only the most substantial issues will be explored. A second section examines clinical translations of basic research, focusing on emerging interventions, an area in which anticipated growth in the coming generation can increase the significance of coparenting work to better the lives of infants and toddlers worldwide. In the third section, initial efforts of an international coparenting collaborative working to draw together best practice thinking from scholars who have provided leadership in this field for a generation are summarized. The fourth section examines the extent to which the field honors and reflects, and aspires to honor and reflect, the sensibilities of all families coparenting young children, particularly those from marginalized and underrepresented groups. The infant mental health field has begun a long overdue reckoning with the absence of racial and ethnic diversity in the history, concepts, and methods that have collectively defined our discipline. To the extent that there has been insufficient equity and diversity of voice in the coparenting field, steps to reckon with incomplete or biased framing must likewise be articulated and advanced.

Major Concepts and Issues in Coparenting Theory and Research

As has been well-documented, coparenting theory and research owe intellectual debt and remain strongly rooted in the structural family theory of Salvador Minuchin (1974). More than most other theoretical approaches, Minuchin's writings provided a sound conceptual framework identifying collaborative, supportive leadership provided by children's caregivers as a key to children's socioemotional health and behavioral adjustment. Minuchin (1974) was also influential in elevating the status of triangular processes. Certainly, Minuchin's work was, and remains, the most comprehensive articulation of the family systems model foreshadowing the multi-parental framework that is the focus of this chapter. However, his theory was but the most fully developed of a long line of innovative approaches that collectively perturbed the conceptual base of the field of clinical psychology—in much the same way as coparenting theory has expanded the original lineage of the infant mental health field (McHale & Sullivan, 2008).

Family systems theories, much like the dyadic models that are the foundational anchor of the infant mental health field, were revolutionary in their emphasis on relational as opposed to individual intrapsychic processes. Both share a common core tenet—that problematic behavior or adjustment seen in children and adolescents cannot be properly understood devoid of their relational context within the family system. However, units of analysis differ. As detailed throughout this Handbook and in innumerable earlier historical accounts, the infant mental health field's base premises center around infant– and child–parent dyadic communication and inter-affectivity—and the untoward consequences of disruptions in these universal processes on intersubjectivity, affect attunement, and attachment (Stern, 1985). By contrast, family systems tenets, which themselves initially originated from investigations with clinical families, elucidate how disturbances of children, adolescents, or young adults are signals of dysfunction within the triadic (Bowen et al., 1959) or "n-adic" (more than three; Ricci & Selvini-Palazzoli, 1984) family unit.

Contemporary coparenting theory adopts such triangular thinking. Particularly for infants and toddlers, but for older children as well, a "triangular secure base" involves not just a coparenting environment in which the adults communicate openly and effectively about children within a clear and generationally boundaried hierarchical system, but in which the family's coparental alliance supports children's secure attachment with each parent—all coparents recognizing and honoring that each of them is emotionally important

to the child. Such thinking, 30 years young in the infant mental health field, has been afoot since the mid-1950s. One of the earliest and most persistent theorists to build the concept of emotional triangles was Murray Bowen. His work was originally influenced by Fromm-Reichmann's (1948) tacitly dyadic theory of the schizophrenogenic mother, but while Bowen initially retained the focus on mother–child symbiosis, he expanded his conceptualization to frame a triangle perspective on schizophrenia.

In Bowen's constructions, fathers passively permitted themselves to be excluded from what he referred to as the "intense twosome" (i.e., mother and child). Subsequently, he went on to explain that a family's "identified patient" (IP) was an unsuccessful mediator of coparents' emotional differences, detailing how IPs were emotionally drawn in as unwitting parties in cases of emotional divorce between parents (Bowen et al., 1959). Bowen initially branded this dynamic an interdependent triad, but around 1961 shifted to using the term "triangle" (Titelman, 1998). Over the years, Bowen's theory expanded to include numerous other inspired concepts, some more and some less relevant to contemporary coparenting theory. For example, his seminal concept of interlocking triangles (Bowen, 1978) has had limited impact within the coparenting field, while his exposition of multigenerational family emotional systems has had more creative influence.

Another legacy of family systems thought relevant to contemporary coparenting theory is the concept that the multi-person family system constraints and organizes interactions at all other levels. Within the broader family system, family members develop emotional interdependencies to a point where the emotional system through which they are connected has evolved its own principles of organization (McHale & Sullivan, 2008). As Patricia Minuchin (1985) explained, taking a family-wide level of analysis altered the formerly prevalent belief that all influences were funneled through the mother "…such that not just children, but each family member, is seen as members of a larger system and studied directly within that unit" (p. 293).

Minuchin's (1985) joining of family systems and developmental theory served as a touchstone for the many subsequent, formative developments that later structured an undertaking frequently labeled "infant–*family* mental health" (McHale & Phares, 2015). Remarkably a few lines of thought capturing the relevance of family systems approaches for developmental theory and research had been advanced prior to Minuchin's analysis. However, within the next decade, a groundswell of fresh conceptualizations and a beginning rapprochement bridging dyadic and family approaches to understanding child socialization and development had begun (McHale & Cowan, 1996). Heading into the new millennium, two of the more noteworthy initial inroads advancing scholarship on coparenting and family-level processes were a series of graded investigations by Fivaz-Depeursinge and her colleagues in Lausanne, Switzerland and by McHale and his colleagues in Berkeley, CA and Worcester, MA.

As had Bowen several decades before—but bringing a trained eye and understanding of very young infants, new observational advances made possible by video technology, and a transformative methodological approach involving carefully documented microanalytic study of eye gaze engagement and playful sharing of effect during infant–parent interactions—Fivaz and her systems-oriented colleagues began examining coparent–child commerce during triangular interactions. The work in Lausanne originally launched with microanalytic studies of *dialogue* interactions in parallel dyads (infant held by psychiatrically referred mother, by non-diagnosed father, and by a stranger); Fivaz found that both decompensated mothers and their husbands often assumed holding contexts (i.e., too far, too close, not in vis-à-vis for face-to-face contact) preventing dialogic gaze. Infants hence did not distinguish their parents' holding as invitations for dialogue, though they did respond reciprocally with eye gaze when held by the stranger. Such problems were not observed among a non-clinical parent–infant control group, though normatively (as they grew older) control infants did begin avoiding eye contact with the stranger.

Fivaz's colleague Antoinette Corboz-Warnery helped nudge a segue from studies of parallel infant–adult lap holding and gaze interactions, to studies of the family as a triad and a triangular method that later became the Lausanne Trilogue Play (LTP; Fivaz-Depeursinge & Corboz-Warnery, 1999). In clinically distressed mothers with young infants, Corboz-Warnery recognized two common multigenerational forms—one in which fathers disengaged, allowing members of mothers' family of origin to assume control over the fragile mother–infant dyad; and a second where fathers themselves took control, excluded the "sick" mother and colluded with members of their own family of origin against the mother. In both cases, infants were harmed by the dysfunctional interactions. It was therein that fathers' roles in families of infants became elevated as part of a *family-level* dynamic, ultimately recognized in four ways—fathers as framers of mother–infant interactions, as direct interactive partners for the baby (with mothers framing *their* interactions); as joint partners with mothers in a coparenting system (together simultaneously framing the baby's experience); and as direct interactive partners with mothers, with the baby in a "third-party" role. These four configurations and "roles" came to be enshrined as the four "parts" of the modern-day LTP (Fivaz-Depeursinge & Corboz-Warnery, 1999).

LTP studies offer insights about how parents and children as an interacting threesome achieve (or fail to achieve) connected, coordinated family engagement, commerce, and trialogue play. Microanalyses of family members' gaze, affect and body postures (torso, pelvis, and shoulder formations, distances, and orientations between the three) revealed, first, partners' inclusion (versus exclusion) in the family triangle. If all were included, body positioning, distances, and orientations signaled propensities to either honor roles as active or as third-party partners, to withdraw, or to behave intrusively. Third, the focus of each person's gaze illuminated whether the family could agree upon a joint focus for play; and last, sharing of affect signals determined presence, absence, and quality of threesome affective communion. All four of these functions were systematized as key determinants of "family alliances."

In 2008, Fivaz provided LTP evidence validating three family patterns S. Minuchin had documented in clinic-referred families coparenting older children: detouring coalitions (involving scapegoating or role reversal); triangulation, where coparents struggled against each other and tried to ally with the child—who when torn between them either took on the role of a go-between or withdrew; and binding, where the child was tied to one parent and in conflict with the other. While Fivaz's (2008) account focused on pathological coalitions during infancy and early childhood, functional or dysfunctional triangles are inherent in all family systems.

As these studies unfolded, 5000 miles away in Berkeley, CA, McHale and his colleagues were likewise studying triangular interactions in families with young infants. Their work also focused on communication, cooperation, and coordination between coparenting adults as they engaged together with the infant at play. However, McHale's studies focused less on the infants' role in signaling and engaging adults, and more on globally recognizable elements of the coparents' framing of semi-structured play interactions with their babies. He identified seven such elements—coparental cooperation, competition, and verbal sparring; discrepancies in levels of behavioral and affective engagement by the two adults with the baby as they played together; child-centeredness (as opposed to adult-centeredness) of the flow and tempo of the interaction; and overall levels of family warmth (McHale et al., 2000a, b). Analyses of these indicators identified three core coparental dynamics operative in all families: low-to-high hostility-competitiveness (characterized by competition, verbal sparring, and parent- (as opposed to child-) centeredness); low-to-high discrepancies in levels of parental engagement (characterized by balances or imbalances in maternal and paternal involvement with the baby during triadic interaction); and low-to-high family harmony (coparental cooperation and family warmth; McHale, 1995). A replication study in Canada (McConnell & Kerig, 2002)

found the exact same factor structure in a sample of toddler-aged children at play during triadic interactions with their parents.

Two early sets of reports from McHale's group documented the relevance of these coparenting dynamics both for later coparenting and for young children's social and emotional development. McHale and Rasmussen (1998) detailed longitudinal sequelae of coparental dynamics observed during infancy. Employing a new "Coparenting Scale" (McHale, 1997) that focused parents on their *own* coparenting behavior during both overt (three-person) family interactions and covert (two-person, parent alone with child) contexts, McHale uncovered longitudinal relationships between observed hostility–competitiveness, low family harmony, and high parenting discrepancies during infancy, and child and coparental functioning 3 years later. More substantive parenting discrepancies in the triad during infancy forecast greater preschool anxiety, while greater hostility–competitiveness and lower harmony foreshadowed higher preschool aggression—even after controlling for individual and marital functioning. Observed coparental process during infancy also predicted parents' self-reports of coparenting behavior 3 years later. The coherence in coparental functioning across time was a striking phenomenon. It was once again documented in a later, more comprehensive longitudinal study of the transition to new coparenthood among first-time parents (McHale, 2007b).

In an ensuing childcare-based study in Berkeley, McHale et al. (1999) found that the social adaptation of 4-year-olds was predicted by coparenting and family-level dynamics. Observed playground interactions with peers over the course of a full preschool year were predicted by the family's affective climate during triadic play and teaching sessions. In families where coparents triadic interactions with one another and with the child were warmer and more positive, children's social interactions were more positive and prosocial. Problematic peer relationships, too, were tied to coparenting and family-level dynamics (lower levels of support and mutuality between coparents) through children's cognitive processes and meaning-making. Specifically, children's representations of the family, inventively evaluated through multiple methods, played an intermediary role. If preschoolers from families with unsupportive coparents had constructed more negative family representations, concurrent peer relations were most problematic (McHale et al., 1999). These seminal accounts linking observed coparental behavior to young child adjustment in non-referred community families were echoed by early reports from Belsky et al. (1996) and Schoppe et al. (2001). After a decade's worth of associated studies, (e.g., van Egeren, 2004; Feinberg & Kan, 2008), coparental-child connections were corroborated in a meta-analysis by Teubert and Pinquart (2010). Research converged to verify how coparental dynamics affect young children's social and emotional development through multiple direct and indirect pathways, affecting security, emotion regulation, and relationships with others.

An understudied phenomenon poised to impact the next generation of coparenting research is how intergenerational forces shape current-day coparenting. While intergenerational transmission has been a cardinal force in attachment theory (Fraiberg et al., 1975; Lieberman et al., 2005; Verhage et al., 2016), its focus has been almost exclusively on dyadic—and not triadic—introjects and has not addressed the repetition of triangular patterns from the historical past. Yet among family systems thinkers, continual influences of origin family dynamics have been addressed. For example, Boszormenyi-Nagy and Spark (1973) "Invisible Family Loyalties" made a case that parents' indebtedness to origin families ("owed" balances and obligations) affected contemporary family processes—even when parents disavowed such debts. Nagy's therapeutic tactics included bringing various members of the extended family together in the present day to focus on damaged relationships. Multigenerational perspectives have also been invoked to explain why children in a present-day family are assigned (or "inherit") formulaic family roles that recapitulate comparable roles present in the family for generations.

Without asking about generational legacies, practitioners may miss data that can help explain misfitted roles imposed upon unaware family members—including young children.

While these premises hold considerable conceptual and allegorical interest, their abstract nature dampens applicability in everyday infant mental health encounters. Only indirectly have researchers explored family-level representations, with no attention given to specialized family roles or responsibilities. Positions about coparenting held by men and women not yet themselves parents can be impacted by lived experiences of having been coparented and shape coparenting of infants (Kuersten-Hogan & McHale, 2021). Such influences are not just limited to the distant past; Bowen's perspective on multigenerational transmission was that the past never left, as family emotional systems press up against and interlock daily with prior generations. As we explore later in this chapter, origin family dynamics can abut contemporarily developing triangular dynamics in families (e.g., Mason, 2020; Wakschlag et al., 1996).

A final, often forgotten impetus for the coparenting field was research and modeling of "normal family processes" (Walsh, 1982, 2012). Whereas early studies examined family formation, marriages, and transitions to new parenthood in primarily European American families, later expositions began tending to diversity and complexity in the twenty-first century families, shifts from deficits to strengths perspectives, and cultural dimensions in family functioning. For its time, such work was catalytic in promoting individually and dyadically focused family scholars to begin to think more expansively about family-level processes and dynamics.

From Basic Research to Clinical Translations: Approaches to Strengthening Coparenting

Given the roots of the coparenting field in family systems theory and therapy, it is surprising that a few therapeutic approaches have directly translated to intervention work with families of infants and toddlers. Certainly, the core notions summarized above—particularly those from S. Minuchin's (1974) structural approach—have penetrated meaningfully. Most therapeutic approaches share the aim of solidifying the boundaries that establish the coparenting adults as the family's executive subsystem, mutually making and carrying forward a joint plan for keeping children safe, nurtured, and emotionally strong. Crucial in improving the family's coparental alliance are heightening adults' conscious awareness and mindfulness about the importance and impact of their joint efforts as coparents, and encouraging more regular, effective communication, cooperation, and coordination between them, regardless of whether they live in a single or multiple domiciles (McHale & Carter, 2012; Pruett et al., 2014).

These aims are clearly represented in dyadic (coparent—coparent) and multi-couple group interventions accruing an empirical evidentiary base. In such interventions, psychoeducational and (less frequently) experiential skill-building elements have been identified as important elements contributing to efficacy (Nunes et al., 2021). However, an additional component of infant–family mental health work—accurate reading of the child's developmental and emotional needs—has been less prominent in coparent–coparent and group interventions. In the *child*–parent dyadic approaches that comprise most of all existing infant mental health interventions with infants and preschoolers, therapeutic encounters typically involve some element of child–parent play. This is true whether the theoretical approach and intervention are behavioral (e.g., Parent–Child Interaction Therapy; Eyberg et al., 2001), therapist-directed (e.g., Interaction Guidance; McDonough, 1995), psychodynamic (e.g., Child-Parent Psychotherapy; Lieberman, 2004), or reflective (e.g., Watch, Wait and Wonder; Muir et al., 1999). However, structural family therapy and its derivatives (e.g., Henggeller et al., 1998; Lindblad-Goldberg & Igle, 2019)—typically carried out with families of older referred children—offer no blueprints or evidentiary base involving coparent–infant or –toddler play. The inclusion of a family play basis

has been most notably explored in a line of intervention that has progressed from the Lausanne Trilogue Play tradition. We hence address each of these approaches to treatment in turn below.

Group Interventions to Support Coparenting

Group interventions have been extensively studied as support for families transitioning to new parenthood. Groups bring together coupled parents to reflect on their relationships and parenthood, to share experiences, and to create new social resources within the group (Cowan & Cowan, 1992). Though most first-generation studies enrolled married mid-socioeconomic status community participants, eventually intervention studies began concerted outreach to couples experiencing higher levels of stress, including lower socioeconomic families and younger couples at disproportionately higher risk for parenting stress, negative attributions about child behavior, and potentially abusive behavior.

Moreover, for parents not in married or committed longer-term relationships, coparenting complications are magnified. For example, in the United States, a national survey of "Fragile Families and Child Well-Being" documented unmarried parents' transitions to parenthood and found that while over 80% of unmarried fathers were at least episodically present during the mother's pregnancy, only two in five remained meaningfully engaged in their child's life by the time that child entered kindergarten. Something shifted over time in unmarried fathers' engagement as active coparents, with an adverse impact on children (McLanahan et al., 2013).

The solution of coordinated large-scale efforts in the United States and a small handful of other nations was to promote positive couple relationships, father involvement, and *coparenting*. Some US initiatives were also adapted to offer programming for unmarried parents. These included federally sponsored Couple Relationship Education (CRE) interventions that brought parents together as couples to focus on improving their relationship (Hawkins & Erikson, 2015) and Responsible Fatherhood (RF) programs designed to help fathers provide financially and seek to build a communicative bond with their child's mother (Holmes et al., 2020). CRE and RF programs often achieved impacts on couple functioning and/or father engagement but were not as effective in promoting coparenting (Hawkins & Erikson, 2015; Holmes et al., 2020).

For these reasons, coparenting *specific* group interventions (foregrounding coparenting of children more so than couple relationships) came into being. Programming varied, with some groups focusing fully on coparenting and others embedding coparenting modules in healthy relationship-oriented curricula. Pilkington et al. (2019), focusing on coparenting group outcomes from the perspective of fathers, reviewed 16 randomized controlled trials (RCTs) that evaluated the effects of 14 coparenting interventions. Eleven of the 16 were conducted in the United States, 2 in Australia, 1 in Belgium, 1 in Canada, and 1 in New Zealand. The pooled sample was 9282 couples; 11 trials recruited parents within the perinatal period or during infancy. While most interventions reported an effect on at least one measure of coparenting, fully half reported either mixed or null findings. The authors concluded that while group coparenting interventions did show some evidence for effects on relationship quality, there was insufficient support for effects on such factors as interparental conflict, dysfunctional parenting behavior, psychological distress, and parenting efficacy (Pilkington et al., 2019).

Nunes et al. (2021) examined the effects of coparenting-specific group interventions on multiple outcomes: quality of coparenting, romantic relationship, parent well-being, parent–child relationships, and child adjustment. Twenty-five RCTs examining 21 coparenting programs were identified, with 16 included in the meta-analysis. Children's ages were not specified, but 7 of 16 studies involved programs for at-risk families, 5 for first-time parents, 2 for divorced or separated parents, and 2 for parents from community samples. Programs for separated, divorced, and community sample parents only targeted the

coparenting relationship while programs for at-risk and first-time parents addressed multiple domains such as coparenting, parenting, and/or the romantic relationship. The meta-analysis verified a modest effect of coparenting programs (overall effect size $g = 0.21$), paralleling significant intervention effects on coparenting support, romantic satisfaction, parental stress, and positive parenting. Only 9 of 16 studies reported child-related outcomes and the meta-analyses did not identify an effect of coparenting programs on children's behavioral adjustment. Emotional aspects of child adjustment were not sufficiently sampled or studied for authoritative conclusions to be drawn.

Overall, coparenting group interventions appear to make a small but measurable impact on (typically self-reported) coparenting and sometimes secondary indicators of individual and dyadic adjustment in the family. However, the effects on infant mental health are questionable.

Dyadic Interventions to Support Coparenting

In 2010, Irace and McHale introduced a dyadic (coparent–coparent) intervention designed to assist parents in targeting coparenting issues they were facing in the family. Incorporating elements from individual, couple, and family interventions, Focused Coparenting Consultation (FCC) explicitly contracted with parents from the onset on an aim to help them collaboratively create effective safety structures to better protect children and support their emotional adjustment—that is, to develop a more effective coparenting alliance. FCC's guiding premise is that for parents to collaborate more effectively as coparents, they must (a) develop greater mindfulness about why coparenting cooperation, communication, and coordination matter for children, and about how they themselves currently coparent; (b) enhance skills needed to promote better cooperation, communication, and coordination; and (c) be guided by interventionist coaching and support, abandon repetitive patterns of ineffective interaction and use their new insights and skills to take hold of problematic issues they face with their children. As in brief dynamic therapy, the focus remains solely on one theme—coparenting—with all diversions created by ancillary issues (e.g., couple intimacy, finances, in-laws) curtailed and parents firmly redirected back to the core of the coparenting work.

Given the modest efficacy of coparenting groups, a family-specific intervention to work with families specifically on coparenting conflicts was something of a gamble. A UK study of a Mentalization-Based Therapy for Parental Conflict—Parents Together (MBT-PT; Hertzmann et al., 2016)—working simultaneously with two separated parents to help them keep their child in mind and consider the potential negative effects of entrenched conflict on the child's well-being—did not improve parents' capacity to perceive or understand experiences of the child or coparent and mentalize on their difficulties. The authors speculated that perhaps being together in the same room may initially make things worse for parents, and later adjusted their approach to allow more time for parents to prepare for being in the same room as their ex-partner.

In some cases, intervening dyadically may even pose possible risks if violence between partners has happened in the past. In the United States, certain states prohibit intervening dyadically if there has been intimate partner violence (IPV; Austin & Dankwort, 2003). At the same time, dyadic interventions can assist couples who decide to stay in relationships following *situational* couple violence (i.e., in a context of escalating arguments *not* driven by power and control dynamics; Stith et al., 2003). For infant–family mental health practitioners, opportunities to work with coparents in higher conflict families as a coparent–coparent dyad (rather than as members of coparenting groups, or individually) can provide direct openings to help parents regulate and manage disputes and control frustration and anger stemming from coparenting conflicts.

Comfort and disposition to invite and amplify coparents' perspectives, criticisms, and complaints may not be strong suits for many infant mental health professionals who work principally

with mothers, or principally with fathers, but not both. As a manualized intervention, FCC offers structure and guidelines for introducing and approaching conflict conversations. In a context of mutually consented-upon agreements that the child will remain the focus, with the work stopped if one or both coparents find it impossible to maintain that focus without bringing up other non-child-related grievances, FCC provides a protected space for the caregiving adults to consider and discuss contentious child-related coparenting issues and concerns.

A recent RCT in which FCC was adapted for use with unmarried African American parents expecting a first child together (McHale et al., 2022a, b) illustrates the utility of the structured approach. Unique to the intervention was its vetting, review, and fine-tuning by senior African American community leaders from the municipality where the intervention was implemented, enhancing its cultural relevance for the families it would serve. The intervention was delivered by a male–female co-mentor pair, experienced Black and African American paraprofessionals (home visitors, health educators, fatherhood specialists) from the community. A licensed clinical psychologist helped assure curriculum fidelity and consulted in cases where significant clinical challenges surfaced. The six-session prenatal intervention (with a 1-month post-partum booster) exerted long-term benefits within the family, with intervention-group families demonstrating better coparenting and greater reductions in psychological aggression at both 3 and 12 months postpartum. Moreover, compared to a no-treatment control group, infants in families where parents received the intervention were rated by both their mothers and fathers as showing less negative emotionality and less aggression at 1-year post-partum. Unlike many group interventions for which child benefits are not shown, FCC appears to have ripple effects throughout the family with infants as well as coparents showing benefits.

FCC has also been modified for relevance to other populations, including "Through the Eyes of the Child" (McHale & Carter, 2019), attuned to concerns of parents from post-divorce families who did not realize wished-for benefits from Parenting Coordination interventions (Sullivan, 2008), and "Strengthening Family Safety through Coparenting" (McHale et al., 2021), sensitive to issues of at-risk families identified for monitoring by Child Protection Investigators to try to prevent a child removal episode owing to child abuse or neglect. The evidence base for newer variants of FCC interventions is not as robust as for the tested intervention with unmarried parents, but the principles—consciousness raising, specific skill-building, and guided practice (enactments)—are the same, with the key being finding effective ways to elevate parental mindfulness and resolve to carry through the intervention. Parents who have received the interventions attest to their direct relevance for their situations and openness to using new skills to support their child and coparent (McHale & Carter, 2019; Salman-Engin et al., 2017), though much more research is needed in this terrain before any definitive conclusions can be drawn.

Interventions Centering upon and Building upon the Lausanne Trilogue Play

Coparenting groups most typically work with couples (or occasionally single coparents; see Pearson et al., 2020), and FCC is a decidedly dyadic intervention involving two coparenting adults. In the latter, children are indisputably the central focus of the intervention, so much so that their photographs are strategically displayed and used evocatively in the session room during the "Through the Eyes of the Child" variant (McHale & Carter, 2019). Even so, however, such interventions rely solely on the represented child and family, rather than the practicing family, (Reiss, 1989) and the child is not an interactive participant in the work itself.

While group and dyadic coparenting interventions do not engage the triangular or full-family system, work that began in Lausanne *has* used the LTP for case consultations with very young families (Fivaz-Depeursinge et al., 2004). Therapeutic consultation models of intervention

are typically brief and center on the relationship between coparents and child. Though specific procedures vary, the essence of LTP consultations is that LTP sessions are video recorded, with recordings of the play later reviewed by expert consultants and/or the treating clinician. During clinician reviews, a few brief excerpts from the session (interchanges between parents and infant that punctuate central challenges of that relationship) are selected. Excerpts that illustrate the family's strengths as well as areas of difficulty are chosen.

The parents (and in some cases, the referring clinician) then return for a review session later to view the video clips of the play and to discuss them with the consultants. For the review, a typical sequence is to start with family strengths before discussing the challenging excerpts, often then ending with another positive clip. As much as is possible, connections are drawn to ways in which the video segments may reflect recurring themes for the coparents and family. Subsequent consultation can also later occur with coparents. Favorable results of consultations have been shown for coparental, parent–child, and triadic interaction quality (Olhaberry et al., 2017). While consults are intended to help parents see and become more mindful of their coparental instincts and leanings when together with their child or children, standard LTP instructions are nondirective. They provide the family with a structure in which to play, and challenge the coparents to coordinate, drawing on their own base inclinations. In a play-based intervention called Reflective Family Play (RFP), Philipp (2012) combined the LTP's consultation structure with elements of the Watch Wait and Wonder (Cohen et al., 2002) evidence-based treatment approach to inveigle parental mindfulness more directly. The RFP approach instructs coparents to reflect and follow their child's lead while at play, as a direct means of stimulating reflective function and sensitivity during triadic or family group sessions.

The RFP allows families to stray without restrictions in the session, assisted by toys that encourage creative play. The same structure is repeated weekly for 8–12 weeks. Reflection (in the second half of each session) is self-driven and not shaped by clinicians. The clinician follows the parents' lead, using clarification and reflecting techniques. Children remain in the session as coparents reflect, and RFP can be used with multi-child families (Philipp et al., 2018).

Most recently, Philipp et al. (2023), impelled in part by adjustments in practice necessitated by COVID clinic closures, adapted the Lausanne Family Play (LFP) to craft an ultra-brief systemic intervention. The LFP-Brief Intervention (LFP-B) for two caregivers and one or more children is delivered in three sessions: a comprehensive play assessment including an LFP with coparents and child (Session 1), a child-focused clinical consult with the parents (Session 2), and a single video feedback intervention session with the coparents (Session 3). After the play assessment, video recordings are reviewed by clinicians before the video feedback session, to find clips reflecting strengths, areas of concern, and symptoms in the child. Unlike the RFP intervention, the LFP-B omits children from the video feedback session, reinforcing the coparental unit as the catalyst of change in family interaction patterns. The intervention is currently being evaluated using a single-arm, pre–post design (Philipp et al., 2023).

Framing Infant Mental Health Work: Taking Steps to Properly Integrate Coparenting

A strong evidentiary base documents the direct and indirect impact of coparent–child triangular relationships on young children's social and emotional adjustment. The joint and shared capacity of coparenting adults, whomever they are, to understand the child or children, to contain child-related conflict, to invest emotionally, and to collaborate effectively to provide coordinated guidance and support for each child collectively help generate a safe, predictable, resilient family environment that enables emotional health and thriving of infants and toddlers. Coordinated, supportive coparenting is vital in families when children face developmental or behavioral challenges (Portes & Vieira, 2020) and several inno-

vative interventions can assist families if coparenting challenges develop. Yet despite advances in the field's appreciation for the importance of coparenting during the early years, when child-related concerns come to the attention of infant mental health professionals, a "dyadic bias" often remains.

To be sure, involving multiple coparenting adults is now far more acceptable and noticeable than in earlier decades, but most approaches provided for families with infants and toddlers who have experienced developmental challenges, trauma, or early adversity continue to conceptualize cases and deliver modes of intervention to single child-parent relationships. Progress is gauged with respect to improved child symptomatology and achievement of dyadic relationship improvement or repair; overlooked is whether change took place in the broader coparental network that constitutes the family infrastructure. Yet among families led by higher-risk parents who themselves have psychological adjustment challenges, sustained improvement in child outcomes can be as or more dependent on coparent and family-level functioning as on the quality of the dyadic interaction with the high-risk parent (Seifer & Dickstein, 2000). For these reasons, attention to the family system and coparental network is important, as they mediate child outcomes, especially in a context of parent risk and pathology (Dickstein et al., 1998).

Recognizing this overlooked component of many diagnostic workups and case formulations, the Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood (DC 0–5: ZERO TO THREE, 2016), formally recognized the importance of the family's broader caregiving environment. On a revised Axis II, DC 0–5 assigned dual emphasis to primary caregiving relationships and to "the caregiving environment." This significant advance laid a foundation for infant mental health providers to estimate the contributory role played by family dynamics—beyond dyadic attachment relationships—as contributory to young children's development and psychopathology.

Despite this significant advance, relatively little coordinated expert guidance has been available to help practitioners translate concepts founded and validated in laboratory studies of coparenting and triangular relationships to their work in infant–family mental health settings. In 2022, an International Coparenting Collaborative (ICC; McHale et al., 2023) comprised of family-oriented infant mental health professionals from seven different countries launched a new initiative to address this gap. ICC scholars all brought extensive expertise with the Lausanne Trilogue Play and wide-ranging expertise assessing and working with coparenting and triangular family dynamics. The ICC reviewed and identified four central dimensions of how coparents and children organize in relating together as a triangular or n-adic system (engagement, teamwork, conflict, and child focus), along with behavioral manifestations of these coparenting indicators during triangular interactions. They then developed and planned field testing of a research- and theory-based clinical approach to the framing of infant mental health encounters for families. The ICC's objective is to develop replicable, generalizable, and contextually valid intake and framing guidelines applicable to professionals in diverse practice settings. Primary aims are the provision of guidance in (a) assessing coparental functioning and strength of family alliance, and (b) communicating with coparents about how and why their unified and cooperative coparenting is essential for helping the family and child return to a healthier developmental trajectory.

ICC sites began seeing families in early 2023 in Lausanne, Switzerland; Stockholm, Sweden; Rome and Pavia, Italy; Toronto, Canada; Safed, Israel; Washington (D.C.) and St. Petersburg (FL), USA. Additional LTP expert contributors from Switzerland and Turkey serve as advisors and team members. Guided by a common intake framework and assessment guidelines, consensus scripts, protocols, and written guidance, the ICC is examining the potential for standardizing implementation in everyday professional and clinical settings and contexts. Partners all conduct systematic intakes and are evaluating the utility of the framework with families comparably assessed in the varying sites and services. As a primary goal is to help non-experts

implement coparenting assessments that can be useful diagnostically, pilot field testing is engaging actively practicing professionals in naturalistic settings. While ICC members themselves are providing necessary clinical oversight, consulting, and engaging in any ways that makes the best sense for the various settings, the work is not the province of experts working in institutional settings that already have substantial expertise and familiarity with the LTP or with coparenting assessments in research labs. Products from the work should hence be of support to infant mental health professionals in incorporating advances from basic and applied research into more of the everyday settings that support the mental health of the world's infants and toddlers.

Equity and Diversity of Voice from Marginalized and Underrepresented Groups in the Coparenting Field

The infant–family mental health field has been dominated by White infant–family experts and researchers and the intrinsic implicit biases about children and families they bring, though concerted efforts have been made in recent years to redress this circumstance (Iruka et al., 2021). In the field of coparenting, although attention has been drawn to coparenting in diverse family systems since the early 2000s (McHale et al., 2002; McHale & Irace, 2011), there remains a robust implicit bias in many corners to view heterosexual biological two-parent co-residential families as a norm against which to compare other families. Sometimes this bias is unstated, and other times it is unabashedly declared and given standing by journals and journal editors. For example, in 2022, a misleadingly entitled article "Two Decades of Coparenting Research: A Scoping Review" did not, in fact, review the coparenting field but "only scholarly peer-reviewed, empirical, quantitative studies conducted in the United States on coparenting in two-parent families consisting of heterosexual adult, resident parents" (Campbell, 2022, p. 6).

The article went on to explain that while cultural variations in coparenting have been documented alongside "a growing number of studies on coparenting (conducted) with samples of parents residing in several countries, to maintain the scope of this review, these studies were excluded" from consideration, as were "studies that focused on adolescent parents, nonresident parents, couples experiencing domestic violence, or those parenting disabled children" (Campbell, 2022, p. 6). While it may be debatable that value remains in further reviews of coparenting in largely Eurocentric two-parent families led by heterosexual co-residential adults 30 years after such studies first made their mark, a more pressing need is for theory and research to identify and assimilate new, contrary, or alternate perspectives by inviting and following the leads of indigenous scholars (McHale et al., 2004). Such voices reflect the rightful expertise essential to best understand understudied children, families, and cultures.

While the pursuit of grand, universal theories of coparenting is ill-advised, from a family systems perspective, in most any family constellation coparenting relationships have the capacity to influence infants' developing dyadic relationships (Bakermans-Kranenburg, 2021). Infant experiences of cooperative coparental interactions may safeguard safety and trust in each relationship; discordant interactions between caregiving adults may prompt uncertainty and hesitation (Hirshberg, 1990). In the Western samples studied most extensively, chronic exposure to dissonance between caregivers affects emotional security, breeds emotion-regulation difficulties, and contributes to resultant behavior problems (Davies & Martin, 2013).

What remains to be learned in the coming generation of coparenting studies is more about how coparenting relationships take root in non-Western cultures, with attention given to both between- and within-cultural differences. Cross-national work led by indigenous family scholars has been on the upswing, though relatively speaking studies of coparenting across cultural and subcultural groups from global perspective are

still uncommon. One early effort to nest coparenting within non-Western contexts was Kurrien and Vo's (2004) exposition of the coparental systems of Indian and Vietnamese heritage families. Their data illustrating how coparenting networks within India are constituted differently depending on whether rural or urban families are considered, and how in Vietnamese heritage families, boundaries of coparenting systems are flexible, with not just grandparents but aunts and uncles vested with full authority to discipline children and carry out other daily caregiving functions. Coparenting dynamics of South and Southeast Asian families were further addressed in a 2013 review by McHale, Rao, and Dinh.

In the decade since, many empirical studies of coparenting in Asian heritage families have appeared in the peer-reviewed literature. Several expanded conceptualizations of family triangles to explore extended networks of relationships around the child, such as circumstances where grandparents assume substantial childcare charge with infants and toddlers in modern urban "4-2-1 families" (four grandparents, two parents, and one child; Zhang et al., 2019). Hoang and Kirby (2020) contend that dynamics of joint care between parents and grandparents in Asian culture bear both similarities and differences to parallel systems in sister non-Western cultures, observing that: (1) grandparent childcare is a cultural expectation; (2) there is high overlap and little distinction between childcare roles and responsibilities of parents and grandparents; (3) parent–grandparent coparenting is often far from harmonious. Grandparents hold greater perceived status and power, parents are bound by filial piety, and coparenting disagreements arise and must be negotiated. As an example, Liang et al. (2021) documented that mother–grandmother coparenting predicted infant–mother attachment security and children's externalizing problems. They speculated that whether children became securely attached to mothers may partly depend on a harmonious alliance between the women, and the grandmother's wisdom to be a patient companion and not a threatening intruder. Liang's work was significant not only in documenting coparenting using LTP observations (extending prior research that had over-relied on self-reported coparenting) but also in confirming earlier findings that when Chinese parent–grandparent coparenting relationships are harmonious (greater coparenting agreement, closeness and support, lower coparenting conflict and undermining), both parent–preschooler relationships and preschooler socioemotional adjustment benefit (Li & Liu, 2019).

Liang et al.' (2021) work reflects an emerging line of work that includes both mother–paternal grandmother–infant networks and mother–maternal grandmother–infant networks in cultures where paternal grandparents often play substantive coparenting roles. In a seminal study examining Turkish mothers and infants playing together with grandmothers in the LTP, Salman-Engin et al. (2017) found that grandmothers call upon more distracting behaviors to commandeer attention and watch passively less often than do mothers. Salman-Engin et al. (2017) also reported that LTP interactions with maternal grandmothers were significantly higher in family warmth than those in which mothers coparented with paternal grandmothers. Liang et al. (2021) also reported that Chinese mothers of young infants had greater intimacy coparenting with their own mothers than with paternal grandmothers, especially early in the coparenting relationship. Similar results were found among Vietnamese families (Hoang et al., 2020).

These advances in the study of Asian heritage families move the study of coparenting within cultural context to needed new levels of discourse. At the same time, they remain nascent given a comparative under-integration of fathers. Fathers have a powerful developmental influence on Asian families even when they do not participate in the work of childcare at all (McHale et al., 2013). It will hence be important for family researchers to honor what Demo and Cox (2000) termed the family's parenting map as they seek to understand coparental process. One such approach is being piloted by the International Coparenting Collaborative described earlier. The cross-site initiative is asking the child's most central caregivers to complete child-centered ecomaps (McHale & Dickstein, 2019) to

systematically chart early coparenting networks at the time of intake. Establishing the full, functional coparenting system is the first step in understanding the often-invisible family structure that supports the baby's early development. A better grasp of within-family coparenting structures and systems worldwide will shed needed light on children's relational experiences within the diverse families in which they are raised.

Asian heritage families are certainly not the only ones for which progress has been made in contextualizing children's development—and for which significant additional work in the decades ahead is needed to properly understand and honor child development in a cultural context. In the United States, significant advances have been made in understanding the sometimes-complex circumstances of coparenting in African American families, where the cultural surround for raising children is decidedly different than that for majority White parents. As Boykin and Toms (1985) outlined, Black parents, unlike White parents in the United States, must navigate three primary socialization tasks: (1) cultural socialization (i.e., values, beliefs, and behaviors unique to African Americans); (2) mainstream socialization (i.e., values of and co-existence within the European American, middle-class culture system); and (3) minority socialization (i.e., messages of awareness and coping styles related to being racially minoritized). While progress has been slow in centering the adaptations of Black parents within the cultural–ecological context in which they occur (Ogbu, 2007), the diversity of family configurations and adaptations supporting the thriving of Black infants, toddlers, and young children in the United States has become better understood.

Specific to coparenting, Billingsley (1968) and Nobles (1985) were among the first to comment on important, understudied attributes of families of African descent, such as the role of extended kin and role flexibility regarding child-rearing. Their work beckoned strengths-based research on Black families (McAdoo & Younge, 2009). Prominent studies of Black and African heritage mother–father dynamics (Boyd-Franklin, 1987, 2013; Kelly, 2003) centered mother–father coparenting in Black families, and strengths-based approaches to understanding Black children's positive psychosocial development in mother-headed Black families' coparenting with a network of familial and communal support (Jones et al., 2003; Sterrett et al., 2010).

Though these advances gave greater visibility and voice to coparenting in Black and African American families, they were also limited in several important respects. One downside of the overdue focus on multigenerational and kinship coparenting among Black families living in the United States (Stack, 1974)—as with Asian heritage-extended family systems—is a comparative under attention to fathers (Livingston & McAdoo, 2007). With this similarity, however, are also marked distinctions. Franklin (2004) described how racism-related stress in the United States has helped contribute to an "invisibility" of African-American men. Black men are affected individually through internalizing mechanisms, and interpersonally as partners, spouses, and fathers (Greer & Cavalhieri, 2019). As McHale and colleagues (2022a, b) detail, obstacles beyond the family include inadequate employment opportunities offering living wages, economic injustice and generational poverty (Ogbu, 2013), calculated obstruction of wealth-building through redlining (Massey & Denton, 1993), policies perpetuating unequal educational systems (Henry & Robinson, 1998), racist policing and criminal proceedings disproportionately separating Black men from families, trauma, and loss stemming from police violence and killings (Smith Lee & Robinson, 2019), and welfare policies favoring single mothers. All affect Black men's lives and relationships with their children. Acknowledgment of these societal constraints led to needed research on complexities involved in coparenting children from Black men's own perspectives (Edin et al., 2009).

Broadly speaking, socioeconomic standing meaningfully shapes adaptations of Black families in the United States much as do rural–urban distinctions in the adaptations of Asian heritage families across many cultures (McHale et al., 2013). In the United States, one prominent adap-

tation elected by many Black couples is cohabitation, which McAdoo and Younge (2009) described as an option at times seen as superior to "legal" marriage as defined by the state. However, whether couples elect to marry or cohabit, coparenting is routine, even in families where parents decide not to pursue romantic coupling at all. In these latter circumstances, Black mothers and fathers nonetheless pursue paths to help them raise biologically shared children collaboratively, even when one parent is non-residential (Roy & Burton, 2007). In recent years, this adaptive phenomenon has inspired scholarship with generative applications for a wide range of contemporary family systems, "living together apart" (McDonnell et al., 2019).

Family systems can be complex, as children coparented in families where Black mothers cohabit in either formal or "social" stepfamilies (Reid & Golub, 2015) often develop connections with mothers' and or fathers' new partners. Boyd-Franklin (2013) described common variants of such family systems, some in which mother's new partners are visible and others in which they serve as "hidden" family members either in name (e.g., introducing a boyfriend to the child as an "uncle") or in presence altogether. In such multi-father family systems, cohabiting stepfathers themselves report acknowledging, accepting, and adapting their involvement to the reality of there being more than one father to the child (Reid & Golub, 2018). Forehand et al. (2016) highlight the importance of properly understanding coparenting in such family systems, as involvement by male cohabiting partners appears to have positive effects for many youths.

Circumstances appear more complex in low-income families where mothers involved in multiple partner fertility (MPF) relationships are "othermothers" (Burton & Hardaway, 2012) to romantic partners' children from previous and concurrent intimate unions. Burton and Hardaway (2012) detail how othermothering is distinct from step mothering, involving culturally scripted practices of sharing parenting responsibilities with children's biological parents. In an analysis of longitudinal ethnographic data on 256 low-income mostly unmarried mothers from the Three-City Study, where 78% of the mothers had been or were involved in MPF unions, Burton and Hardaway (2012) found that most had other-mothered children of friends and relatives. Strikingly, however, 89% indicated that they did *not* coparent partners' children from any MPF relationship. Mothers' choices were shaped by several factors, including gendered scripts around second families, and their own desires for their romantic partners to child-swap. Hence, despite advances in understanding complexities of families in which new partners come to contribute and play roles in children's care and upbringing, the structure, and dynamics of coparenting in families where there may be novel nonmarital romantic relationships; how coparenting dynamics evolve over time; and how non-residential mothers and fathers move into and out of coparenting systems (e.g., Gürmen et al., 2017) remain understudied.

Similar limitations exist in current understandings of multigenerational and kinship coparenting (McHale & Jones, 2021). Burton (1992), for example, articulated concerns about how descriptions of Black grandparents or great-grandparents frequently offer stereotypical portrayals of grandparental roles, especially for women. Common characterizations either of grandparents as surrogate parents or of grandmothers as family matriarchs reflect just two of countless possible variations in contemporary Black families. Equally the coparenting field has incomplete renderings of the roles of blood and fictive kin closest to children, or of such individuals' embeddedness in broader cultural and relational systems. As Black families in America have had to navigate persistent historical and structural racism and discrimination, there has been an ethic of collaborating within communities to help assure care and protection of children (Stack, 1975). Attunement to patterns of interactions among networks of family and friends involved in Black children's lives is needed to guide better conceptual and empirical work in coparenting studies.

Most coparenting research with Black mothers and fathers, at least in the United States, engages lower-income families, creating confu-

sion between Black and low-income coparenting. Given a nefarious history in the US promulgating deficit-laden portrayals of Black families (Cassiman, 2008; Moynihan, 1965) before the rise of true counter-narratives recognizing family resilience (e.g., Bocknek et al., 2017), thought must be given not just to coparenting structures and dynamics of mid- and upper-socioeconomic families, but also to how the context of social status affects coparenting (e.g., Currenton et al., 2018). Sudarkasa (1997) underscored that such careful scholarship is not only needed but may be particularly illustrative for understanding the challenges Black families face as they transition from lower to higher classes, to understand how communalism and extended family networks are affected across such transitions.

As Causadias et al. (2022) point out, scholars of African, Latin American, and Caribbean origin have been painfully absent throughout the development of core infant–family relational scholarship. Only once the lived experiences of BIPOC scholars and families are better centered can the field become truly anti-racist, considering, and attending to the structural nature of racism. Independent and collaborative ventures are both crucial. One collaborative devoted attention to understanding mother–father–child triangles among lower income unmarried family systems led by Black and African American coparents (Gaskin-Butler et al., 2015; McKay et al., 2021). Privileging mother–father–infant triangles in unmarried, lower income African-American families are unusual in a context of coparenting research that elevated examinations of mother–grandmother and kinship system coparenting (Jones & Lindahl, 2011). However, collaborative discussion among Black community leaders, advocates, and civic leaders in the community where the investigations of mother–father–infant triangles were considered helped not only center the work in community wisdom and values, but assured that planning, oversight, and implementation would be led by those who understood families best (McHale et al., 2022a, b).

Embedding coparenting in a broader community support network honors distinctive, adaptive dynamics of Black families in collaborating within communities to care for and protect children and navigate structural racism and discrimination. If collaboratives are led by the guidance of once minoritized voices, a proper path toward understanding and supporting Black children and families can be charted. Equally, lessons learned about coparenting and triangular relationships in lower-income Black families do not illuminate the coparenting structures and dynamics of all Black families in the United States or of Black families raising infants in disparate nations. However, community partnerships and collaboratives similarly elevating the authority of Black professionals and community members, who are skillfully practiced in the field of infant family mental health, by way of both clinical practice and research as well as through lived experience can help better anchor the infant–family mental health field.

Given the importance of understanding cultural sensibilities to understand coparenting, it might be anticipated that inter-racial and inter-ethnic couples may experience more coparenting challenges after the birth of a child than same-ethnic parents. Kil et al. (2022) have tested an Interracial Couples' Life Transitions (ICLT) model to address this question and examine heterogeneity of interethnic parents' coparenting quality. Examining coparenting trajectories of 574 interethnic mother–father unions and 574 matched same-ethnicity mothers and fathers, Kil found that Asian, Black, Hispanic, and White interethnic parents reliably experienced lower and decreasing trajectories of coparenting quality during infancy and childhood. However, Kil's data also indicated that most interethnic coparents (75.5%) manifested a contented (stable and high) coparenting profile. These preliminary data suggest that while interethnic parents do appear to experience more coparenting difficulties across time than do their counterparts, most interethnic parents succeed in achieving stable and content coparenting across time.

Beyond under-represented racial and ethnic groups, new scholarship is needed to better understand coparenting diversity in the LGBTQAI+ community. As Patterson has noted for decades (e.g., Farr et al., 2019), children of

same-sex parents are as well-adjusted as children of heterosexual parents, with links between coparenting and child well-being comparable in homosexual and heterosexual adoptive families. However, most studies involve children between toddlerhood and adolescence, with limited research on triadic interactions of same-sex parents and infants (Mazzoni et al., 2016). Further, as McHale and Sirotkin (2019) have noted, same-sex coparents live in urban and rural, socially progressive and socially conservative communities (Gates, 2013). Research on contextual effects on coparenting must reflect such diversity. Finally, studies of transgender parents' coparenthood are almost altogether absent in the research literature. Although there is a small literature on adaptations (e.g., division of labor, Tornello, 2020; stress and resilience, Veldorale-Griffin & Darling, 2016) of families led by transgender parents, there is no known research on triadic interactions of transgender parents and their infants. Such work promises to provide telling new insights that will help illuminate mothering, fathering, and family dynamics (Biblarz & Savci, 2010; Doucet & Lee, 2014).

We have only scratched the surface regarding that presently known about coparenting in diverse families. More detail is available in related pieces (McHale & Sirotkin, 2019). While there has been strong initial progress, a generation of new and revealing research beckons.

Summary and Key Points

Strong beginning progress has been made in identifying effective modes of intervention for coparents of young children with behavioral challenges, and efforts are underway to help make coparenting scholarship more useful in everyday infant mental health settings. Though it is now recognized that most of the world's infants and toddlers are coparented in their own unique family constellations, a large swath of the field's knowledge base was founded on studies of co-residential European heritage mothers and fathers. Fortunately, research engaging understudied families is on the rise and contributing to the expansion and reconsiderations of core coparenting tenets. New scholarship must recognize the functional coparental networks of children within their families and document ways in which coparenting processes uniquely impact the lives of infants and young children. Bounds of this work are unlimited and will be among the most important undertakings for the field of infant mental health in the decades ahead.

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Adolescent Mothers of Young Children

21

Sydney L. Hans

Globally, an estimated 16 million adolescents aged 15–19 give birth every year, as well as another 2 million under the age of 15. Adolescent birth rates vary greatly across global regions, with the highest rates in West and Central Africa (115/1000 adolescent women) and the lowest rates in Western Europe (8/1000) (United Nations Population Fund—UNFPA, 2022). Within the developed world, rates of adolescent childbearing also vary substantially, with the highest rates in the United States (USA) (15.4/1000) (Osterman et al., 2022).

Early childbearing is deeply linked to economic conditions and women's access to education and economic opportunities. 95% of births to teenagers take place in middle- or low-income nations, with adolescent birth rates five times higher in the least-developed countries compared to high-income nations (Blum & Gates, 2015). In some of the nations with the highest adolescent birth rates, there are notable gender disparities in power and opportunity; girls cannot access affordable education, cultural and religious traditions promote child and adolescent marriage, young women lack information on sexuality and birth control, and quality reproductive health care is unavailable or unaffordable. Within developed countries, teenage childbearing rates are highest among women living in poverty and those who are marginalized because of race, ethnicity, or immigration status. In the USA, teenage birth rates are highest among the relatively poor states of the deep south (e.g., 27.9/100 in Mississippi) and lowest among the more affluent states of the northeast (e.g., 6.1/1000 in Massachusetts). Teenage birth rates in the USA are higher for American Indian (25.7/1000), Hispanic (23.5/1000), and non-Hispanic Black (24.4/1000) teenagers than for non-Hispanic White (10.4/1000) and Asian (2.3/1000) adolescents (Osterman et al., 2022).

Adolescent births and birth rates have declined steadily and markedly over the past half-century in virtually every nation of the world. Decreases have been most notable in developing nations, where they have paralleled better economic and educational opportunities for women, access to birth control, and attention from the international community to teenage pregnancy prevention and women's rights. Adolescent birth rates have also dropped in developed countries. In the USA, teenage childbearing is at an all-time low, and decreases have occurred in all states and across all racial/ethnic groups (Osterman et al., 2022). These decreases in births to adolescents have occurred along with a broader shift in cultural norms for women to delay childbearing until their later twenties and thirties and during a time when teenagers have increasingly had access to information regarding reproductive health and

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contraception options (Boonstra, 2014). As young women in the USA and elsewhere have more opportunities to choose whether and when to begin childbearing, those who do become pregnant as teenagers are increasingly those who are the most marginalized from opportunities for educational and occupational success.

Changing Perspectives on Adolescent Pregnancy and Parenting

Around the globe, adolescent childbearing is widely viewed as a cause for concern and a situation to be prevented. Most readers of this chapter likely take it for granted that teenage childbearing is problematic and are seeking ideas regarding how the field of infant mental health might contribute to finding solutions to the problem. Yet, many widely held claims about teenage childbearing do not closely align with public health and social science data or the experiences of adolescent parents. A primary goal of the chapter is to critically summarize findings in scholarship on adolescent childbearing and, in doing so, to encourage readers to reflect on their beliefs about adolescent childbearing and parenting. In order to start this reflection, it is important to understand the history through which adolescent childbearing was constructed as a social.

The idea of teenage pregnancy as a significant social problem first gained prominence in the USA. Throughout most of American history, the public had deep moral concerns regarding out-of-wedlock childbearing, but adolescent childbearing was not deemed to be of concern as long as it was in the context of or soon followed by marriage. "Shotgun" marriages for pregnant teenagers were common, and even for older couples, unplanned pregnancies were fairly common but quickly followed by marriage (Furstenberg, 2007). In the USA, fertility rates across all demographic groups skyrocketed after the Second World War, following years of delayed family formation related to the great depression and the war mobilization of men, producing the demographic "baby boom." In 1960, half of American women were married by age 20, with childbearing following soon after, and rates of births to teenage mothers peaked (at 90/1000) (Furstenberg, 2016). Late adolescence was considered an appropriate time for women to enter marriage and start their families.

However, rates of adolescent childbearing began a steady decline after 1960. The second half of the twentieth century was a time of rapid economic and social change in the USA that led to large transformations in the nature of families. The nation was rapidly shifting from a manufacturing economy, where well-paying jobs were available to those with limited education, to an economy that valued a college education. Work of the kind that could support families was increasingly only available to those with higher education. As post-secondary education became more common among the middle and even working classes, delaying careers, marriage, and childbearing until the twenties or even thirties came to be perceived as normal and desirable.

The 1960s and 1970s were also a time of rapid changes with respect to the roles of women in society, resulting from the Women's Movement, as well as the expanding ability of women to control their reproductive lives with the availability of effective hormonal birth control, and greater access to legal pregnancy termination following the Roe v. Wade Supreme Court decision. With the increased ability to control pregnancy, new opportunities opened for many women to delay motherhood and pursue higher education and careers.

During the same time period, premarital sexual activity rapidly escalated for adults and adolescents, and stigma regarding premarital sexual activity decreased. With the changing economy and their own improved prospects for employment, it made less sense for pregnant women of any age to enter marriages with children's fathers, especially if they were undereducated and underemployed (Furstenberg, 2007). The number of women of all ages who became pregnant and chose to raise their children outside of marriage increased. African American men were most likely to suffer from the changing labor market, which contributed to African American families

being at the vanguard of the trend to female-headed families, although other racial and ethnic groups soon followed suit.

It was during this context of rapid societal change, including decreasing rates of teenage childbearing, that the idea of teenage pregnancy and parenting as a social problem exploded into the public consciousness. At the end of the 1970s, teenage childbearing was portrayed by the media, political leaders, advocates for reproductive rights, and social scientists as a crisis (see more detailed historical accounts in Furstenberg, 2007). One of the earliest high-profile sources to identify teenage pregnancy as an important social problem was a monograph published by the Guttmacher Institute (1976). Motivated by a desire to make reproductive health services more accessible to teenagers, the document declared adolescent pregnancy an "epidemic" and a growing problem despite nearly two decades of decreasing rates of adolescent childbearing.

During the 1970s and 1980s, most major magazines and newspapers had features that elevated teenage pregnancy as a national crisis through which young mothers were harming themselves, their children, and society more broadly. Kelly (1996) described the media coverage as a "stigma contest" to identify all the types of deviance perpetuated by teenage pregnancy, including intergenerational social welfare dependence, school dropout, crime, sexual promiscuity, family dysfunction, and substance abuse. The media discourse was highly racialized (Barcelos & Gubrium, 2014). Even though a largest number of teenage mothers at the time were non-Hispanic white women (Livingston & Cohn, 2010), pregnant teenagers were primarily portrayed by the press as urban African American residents who were starting a lifetime of dependence on public assistance for economic support. Although media narratives sometimes suggested the moral failings of young women who engaged in premarital sex, the stories also conveyed a sense of the young women's failure to make rational choices in planning their pregnancies and shaping their future lives. The implicit message in almost all the media discussions was that teenage mothers were the root cause of many other social problems, particularly those in the inner city.

Policy thought leaders of all political persuasions had fully embraced the problem of teenage childbearing as a major talking point with liberals calling for increased access to family planning and conservatives concerned about the deterioration of family values and the amount of public tax money that was being spent on teenage mothers and their children over their lifetimes. To this day, American politicians debate whether the best way to address teenage pregnancy prevention is through abstinence prevention approaches or more comprehensive evidence-based approaches (Santelli et al., 2006), but there remains bipartisan agreement that preventing teenage pregnancies is a national policy goal of the highest importance.

Soon after teenage childbearing became elevated as a social problem in the USA, many other nations and regions of the world also began framing teenage pregnancy and childbearing as a crisis. Within the United Kingdom, a similar public narrative arose that "teenage motherhood is a pernicious social problem where mothers, their children and society generally will all suffer" (Duncan, 2007, page 307), but more than in the USA, the national discourse also focused on the threat to public health emanating from teenage childbearing (Bonell, 2004). In other parts of the world, alarm about the problem of teenage pregnancy remains focused chiefly on moral and religious concerns regarding out-of-wedlock pregnancy (Bradley, 2018). As in the USA, where concern regarding adolescent childbearing seems to be far greater for young women from marginalized racial and ethnic groups, other nations also reserve particularly harsh judgments for teenagers from marginalized and indigenous populations (e.g., Eni & Phillips-Beck, 2013).

In the 1980s and 1990s, social and behavioral scientists did their share to confirm that adolescent childbearing was a problem of high concern, providing an avalanche of data on the consequences of adolescent childbearing. The work showed that, compared to other women, those who became parents as teenagers had lower educational attainment and adult economic stability

and that their children had poorer health, behavior, and educational achievement (Koffman, 2011). In the past decade, however, much of that research has been soundly critiqued for having failed to take into consideration how women who became mothers at young ages differed from other women, even before becoming pregnant, particularly in terms of their economic well-being (Weed et al., 2014). Notably, sociologist Frank Furstenberg, who was an important contributor to early research on adolescent parenthood, recently reevaluated his conclusions about the impact of teenage pregnancy, stating that the true problem of adolescent childbearing is actually the "long shadow of disadvantage rather than age per se" (Furstenberg, 2016). Childbearing as a teenager is not why some young women and children do not thrive, but rather a marker of their social marginality and inequality. It is far more accurate to say that teenage childbearing is caused by poverty than that it is a cause of poverty. Furstenberg noted how in the public mind in the USA, teenage pregnancy and parenting has come to strongly signify something more than simply people having children before they are fully prepared. The rhetoric and research focused on the social pathology of teenage pregnancy has exaggerated the costs and suggested solutions focused solely on pregnancy prevention, rather than on providing supports to help families achieve economic independence and for young people to have access to high-quality schools and health care.

Research on Adolescent Motherhood

Newer waves of research have asked questions and employed methods that provide more accurate, nuanced, and complex characterizations of adolescent childbearing—that provide a less monolithically negative view. This chapter will examine research on adolescent motherhood from three contemporary research approaches. First, it will review studies on the consequences of adolescent childbearing for young women and their children, after taking into consideration as much as the data allow, whether young families are at risk because of mother age per se or other factors associated with early childbearing. Second, it will review studies that move past the view that adolescent childbearing is invariably problematic to examine sources of variation among young parents that lead to problematic or resilient outcomes. Third, the chapter will review studies that, instead of relying on easily quantifiable outcomes chosen by researchers, employ qualitative/narrative research methods that capture the experiences and views of young mothers themselves.

This chapter cannot do justice to all the issues and concerns related to adolescent childbearing. Much of the research summarized here comes from the USA and other high-income countries, but when studies are available from middle- and low-income regions of the world or from indigenous populations within high-income countries, those findings will be included.

Research on the Consequences of Teenage Childbearing

Since the first reports in the 1980s showing problematic outcomes for young mothers and their children, studies examining outcomes of adolescent childbearing have used increasingly sophisticated data analytic approaches that take into consideration factors other than mother age that may have preexisted young women's pregnancies. Across many outcome domains, young mothers and their children have more concerning developmental trajectories than their peers who delay childbearing or than older mothers and their children. However, such disparities in outcomes related to maternal age are usually greatly reduced or eliminated after taking other factors into consideration. Four outcome domains of relevance to the field of infant mental health have been most extensively studied in the teenage childbearing literature: (1) maternal educational attainment, (2) maternal and infant health, (3) parenting and parent-child relationships, and (4) child development.

Maternal Educational Attainment

Much research has focused on whether adolescent childbearing prevents young women from completing secondary education or continuing with post-secondary education and in the long term from securing well-paying jobs or depending on social welfare for income support. Studies in high-income nations, utilizing large nationally representative databases, typically show that, compared to women who began childbearing in their twenties, those who became parents as teenagers were more likely not to complete high school, with average reductions in educational attainment between half a year and two years (Kane et al., 2013).

Yet, women who begin early childbearing may already be on trajectories toward low educational attainment before their pregnancies, coming from families with limited resources and communities with poor-quality schools and few employment opportunities. Many have already left school by the time they become pregnant. In recent years, American and European economists have had a methodological field day studying adolescent childbearing by creating ways to control for preexisting differences among women using sophisticated statistical tools. They have also employed innovative contrasts, such as comparing women who became parents as teenagers to those who became pregnant but miscarried as teenagers (Ashcraft et al., 2013) or to close female relatives who did not begin childbearing during adolescence (Francesconi, 2008). These studies mostly conclude that reduced educational and economic attainment among adolescent mothers can in large part, although not entirely, be attributed to socioeconomic disadvantage and lack of opportunities that preexisted pregnancy and parenting. Moreover, longitudinal studies suggest that many young women from less advantaged situations who leave high school before graduation frequently catch up during their twenties by earning equivalency diplomas or seeking further training (Oxford et al., 2010), narrowing the educational consequences of early childbearing over time. Teenage childbearing does not impact educational attainment equally, with the youngest mothers and those already experiencing poverty, most seriously impacted.

Whether young mothers experience educational setbacks depends greatly on education policy. US policy has changed over time in ways that encourage young mothers to remain in school. Many American school systems once had formal policies in place to expel pregnant teenagers from school or to enroll them in alternative schools that were often of low academic quality. With civil rights legislation implemented in the 1970s, school policies discriminating against pregnant students became illegal across the USA and educational outcomes for pregnant student improved (Guldi, 2016). Additionally, some school systems have implemented policies and programs in which they provide critical resources to parenting students such as onsite childcare, educational flexibility, tutoring, and internships that have improved school attendance and graduation (Steinka-Fray et al., 2013).

The impact of adolescent childbearing on education in less developed regions of the world depends on the general availability of education. In South Africa, a country with high rates of secondary school enrollment, including for girls, the system encourages girls to resume attending school after giving birth, although policies are not always implemented by local leaders and young women are unaware of the support available to them (Hagues & McCarty, 2022). The result is that although many young mothers return to school, they have nearly twice the odds of dropping out of school and five times the odds of not passing examinations that qualify them for college entry.

In contrast, in some African nations, free compulsory education only extends through grade 6. Most girls have already left school by the time of puberty (Elondou-Enyegue, 2004); although access to education is improving for girls, the issue of pregnancy as a cause of school leaving has begun to emerge. For girls who are in school when they become pregnant, most African Union countries have adopted measures that protect pregnant girls' and adolescent mothers' rights to stay in school, although those policies are unevenly implemented, and some countries still

have policies that allow for or require expulsion. Even in countries that provide legal protections for pregnant girls to remain in school, stigma and family economic hardship may still push them to leave school.

Maternal and Infant Health

Health data drawn from large-scale population studies and nationally representative surveys in Europe and North America have suggested that young maternal age is associated with a variety of poor maternal and infant health outcomes, most consistently preterm delivery and low birthweight (Eliner et al., 2022), but also hypertension, sexually transmitted diseases, preeclampsia, and lower infant Apgar scores. These poor health outcomes were greater for mothers ages 15 and under than for older adolescents. Although teenage mothers generally have poorer pregnancy and birth outcomes than women in their late twenties, they have better or similar outcomes to women over 35 (Osterman et al., 2022), particularly with respect to lower rates of gestational diabetes and cesarean and instrumental delivery (Eliner et al., 2022).

Studies that have closely controlled for the sociodemographic correlates of maternal age found that poorer birth outcomes for teenage pregnancies were largely attributable to poverty (Dennis & Mollborn, 2013). In the USA, there are substantial maternal health disparities related to race, and African American adolescent mothers have poorer health outcomes than White adolescent mothers (Gilbert et al., 2004).

Studies within low- and middle-income countries also find that maternal age has a U-shaped relation with maternal and child health, with teenage mothers, especially the youngest teens, and older mothers having more preterm births, low-birth-weight babies, stillbirths, and perinatal mortality infant mortality (Akseer et al., 2022). Conditions where the population is widely undernourished and underweight may exacerbate health disparities related to maternal age, with adolescents often having worse nutritional status than older mothers given the competing nutrient demands between a fetus and a mother who is still growing. Although globally, pregnancy and childbirth are the leading causes of death among teenage girls, within developing nations, maternal mortality is high across the board, and older mothers have a more elevated risk of death than adolescents (Nove et al., 2015). Moreover, within low- and middle-income countries, adolescent mothers are less likely to utilize maternal health services than are older women and lack of access to maternal health care may disproportionately impact the health of younger compared to older mothers (Choudhury et al., 2018).

Parenting and Early Parent-Child Relationships

Multiple studies, mostly from US samples, show that, on average, mothers who gave birth as teenagers are less sensitive and responsive to their young children than older mothers. It remains unclear how much of this difference is related to socioeconomic differences between older and young mothers. Studies that have been careful to compare teenage mothers to older mothers who live in comparable levels of poverty have produced mixed results. Some find few differences in parenting behavior between adolescent and older mothers (e.g., Andreozzi et al., 2002), but others find that mothers who gave birth as teenagers are more likely to be unsupportive, detached, and harsh with their infants (Berlin et al., 2002; Lee, 2009). Data suggest that younger adolescents may provide less competent parenting than older adolescents (East & Felice, 1996; Hess et al., 2002) and relatedly that factors presumed to reflect brain maturity, such as executive functioning (Chico et al., 2014), are associated with more nurturing parenting among adolescents.

Early Child Development

Numerous studies have shown that young children born to teenage mothers have poorer achievement on standardized assessments of reading, vocabulary, and mathematics and are less prepared to enroll in kindergarten than children born to older women. As in studies of maternal education and health, when sociodemographic factors are controlled for, the impact of adolescent childbearing on children's academic achievement is minimal (Fagan & Lee, 2013).

Poorer cognitive developmental outcomes are concentrated among the children of the youngest teenagers—with no clear differences between children of older teenagers and mothers in their early twenties (Levine et al., 2001).

Studies from across Europe and North America also suggest that the young children of teenage parents have more behavior problems in early childhood than the children of older mothers (Agnafors et al., 2019), with children of young mothers particularly likely to show hyperactivity and attention deficits (Pohlabeln et al., 2017). Studies that controlled for social factors found that these effects were, for the most part, related to socioeconomic status and limited resources (Mollborn & Dennis, 2012), although a meta-analysis of all available data suggests a consistent, yet quite small, impact of young mother age on child externalizing problems (Lee et al., 2020).

Important Sources of Variation Among Young Mothers

When viewing adolescent childbearing as a social problem, research tends to focus on identifying domains in which young mothers and their children fared poorly compared to older mothers. Yet, there is great variability among outcomes within populations of teenage parents and their children, and a focus on group differences keeps hidden families that are doing well and the reasons they are doing well. Studies of teenage mothers thathave used advanced statistical methods to identify typologies of teenage parents conclude that the largest number of teenage mothers are successful as parents despite challenges they may experience; a smaller group have intermittent health, financial, substance use, and relationship problems or problems in one area of functioning; and an even smaller group were prone to more serious problems over time (Easterbrooks et al., 2011; Noria et al., 2007; Oxford et al., 2005).

Other studies have examined how specific important sources of variation relate to young mothers' parenting and to the development of their children. Following are brief overviews of studies examining variation among young women with respect to their histories of adverse experiences, maternal emotional distress/depression, and their social relationships.

Adverse Childhood Experiences

Studies conducted in different parts of the world all confirm that there is a strong linear relation between the number of childhood adverse experiences and risk of becoming a parent as a teenager (Hillis et al., 2004; Kappel et al., 2021; Wei & Yu, 2014). Women with childhood histories of maltreatment are at greatly increased risk of experiencing an early pregnancy (Garwood et al., 2015). In a study of nearly 30,000 adolescent mothers in California, public records indicated that 20% had been reported to child welfare systems as victims of maltreatment during their childhoods, and 10% had spent time in foster care as children, with an even higher rate of system involvement for those under the age of 16 when giving birth (Madigan et al., 2014).

Young mothers with histories of traumatic experiences show less sensitive and more violent and intrusive behaviors with their infants than young mothers without histories of traumatic experiences (Moioli et al., 2022). Adolescent mothers with histories of physical or sexual abuse are more likely than other young mothers to display angry or neglectful parenting (Bartlett & Easterbrooks, 2015; Spieker et al., 1996). Children whose adolescent mothers had histories of abuse were more likely to display insecure attachment behavior and externalizing behavior problems than children of other adolescent mothers (Pasalich et al., 2016; Stargel & Easterbrooks, 2020). Notably, however, within samples of adolescent mothers who had experienced maltreatment, the majority did not perpetuate the cycle of maltreatment (Bartlett & Easterbrooks, 2015). Qualitative research also suggests that most young mothers break the cycle of intergenerational maltreatment (SmithBattle, 2018), and they do so by making clear goals not to repeat their childhood experiences and by drawing on a variety of resources that might be available to

them, including employment, stable male partners, and supportive family members.

Maternal Emotional Experience

Adolescence is an age of high vulnerability to depressive symptoms. Many but not all studies of postpartum depression in the USA and Western Europe report higher rates of depressive symptoms among teenage mothers than in older mothers (Hipwell, 2014), although young women who become pregnant may have experienced depressive symptoms prior to the pregnancy. Studies in sub-Saharan Africa also show higher rates of depression and suicide among pregnant adolescents compared to older mothers (Kassa et al., 2021; Mutahi et al., 2022).

Those young mothers who experience depressive symptoms are more likely than other young mothers to experience problems in parenting behavior in young mothers, including less responsive and sensitive parenting behavior, inconsistent overly directive parenting, less positive involvement between mother and infant, and harsh parenting (Driscoll & Easterbrooks, 2007; Edwards & Hans, 2016). Young mothers' depressive symptoms are also related to their negative perceptions of their child (Lee & Hans, 2015) and across many studies to reports of internalizing and externalizing behavior problems in their young children (e.g., Black et al., 2002; Edwards & Hans, 2016).

As many as a third of young mothers report experiencing significant distress related specifically to their parenting role, although longitudinal studies suggest that parenting stress decreases across the first year of life for young mothers (Johnstone & Mulherin, 2020; Menon et al., 2020). Those young mothers who are experiencing parenting distress are less positive and less sensitive in interaction with their infants than other young mothers (Planalp et al., 2022). Despite considerable attention to variation in negative emotionality among young mothers, very few studies have looked at positive aspects of young mothers' emotional experience, such as parenting satisfaction or other aspects of emotional well-being. One Australian study determined that more young mothers were experiencing psychological flourishing than distress and that flourishing was closely linked to their experience of support from others (Johnstone & Mulherin, 2020).

Experiences of Support

Numerous studies have shown that young mothers who receive strong support have more positive experiences of parenting and show more sensitive parenting behavior than other young mothers (e.g., Angley et al., 2015). In addition to directly impacting young mothers' parenting, support can serve to protect or buffer parenting in the context of adversity, meaning support matters most for mothers who are the most vulnerable. For example, there is a positive association between support and maternal empathy for mothers who had themselves been neglected as children, but a weaker relation for mothers who had not been maltreated (Bartlett & Easterbrooks, 2015). Although support generally serves as a positive function, when support is accompanied by conflict or criticism, it may undermine the mother's parenting and well-being (Barrera, 1981).

Much of the literature on support for adolescent mothers has focused on support provided within two key relationships: the young mother's mother (grandmother of the infant) and the infant's father. Most teenage mothers in the USA and many other developed countries are unmarried and continue to live in a household with their families after giving birth. In multigenerational household, grandmothers provide important emotional support, advice, feedback, and modeling of parenting behavior to their daughters, and the quality of those relationships matters for teenage mothers' parenting. Adolescent mothers whose relationship with their mothers is more communicative, open, and flexible demonstrate more positive, confident parenting behaviors in interaction with their children (Oberlander et al., 2007). However, within multigenerational, often low-income households, there can be high levels of stress, and help from grandmothers that is accompanied by high levels of conflict or demands to reciprocate by helping with household chores does not promote a young mother's

parenting competence or emotional well-being (Perez-Brena et al., 2015; Seay et al., 2016). Conflict between mother and grandmother is also associated with more externalizing problems in young children (Seay et al., 2016).

In multigenerational households, grandmothers and adolescents can share childrearing roles in a variety of ways (Apfel & Seitz, 1991). Young mothers benefit most from grandmother support when their mothers adopt an apprentice approach—actively encouraging and teaching the young mother, stepping in when needed, but not taking over caregiving responsibilities (Oberlander et al., 2007). An apprentice approach strikes a balance between the support of the young mother and allowing her autonomy to develop as a parent. In families where grandmothers provide large proportions of the care of infants and young children, to the exclusion of the young mother's participation, young mothers show less sensitivity to their infants/children (Contreras et al., 1999) and demonstrate higher potential for abuse (Seay et al., 2016), and their infants disengage from mothers during interaction (Easterbrooks et al., 2005). Multigenerational families sometimes adopt a pattern of "adversarial care" in which a young mother is forced into her role as a mother or excluded from it (SmithBattle & Leonard, 2014). In these families, when issues of control and authority become central to family interactions, when there is competition over the baby, conflict over caregiving tasks, and hypercritical attitudes, it becomes difficult for young mothers to gain experience and pleasure from interacting with their baby.

In the USA, nearly all adolescent childbearing occurs outside of marriage and in only a small proportion of teen-parent families do the young mother and father co-reside at the time of the pregnancy or birth, although it is not uncommon for young couples to eventually live together within three years after birth (Manning & Cohen, 2015). Even though many young unmarried fathers are highly involved with the teenage mother of their child (Howard et al., 2006), particularly in the time frame around the birth (Bellamy et al., 2015), on average, father involvement declines notably over the first year after birth.

Fathers vary greatly with respect to the support they provide the mother of the child and their child. Since most partners of teenage mothers are young men who face barriers to employment based on their age and structural factors, few are able to make significant financial contributions to the care of a child. Because the economic provider role is core to most young parents' definitions of fatherhood (Jaime et al., 2015), some feel inadequate as fathers or are viewed by young mothers as lacking and disengaging from their child. In contrast, other young men see just "being there" for their child as the core of fatherhood (Florsheim & Moore, 2020) and are eager to support mothers and their children in nonfinancial ways, such as taking an active role in caring for the child.

Variation in the quality of the relationship between young parents is linked to maternal adjustment and parenting, with good quality of the mother-father relationship associated with the mother's parenting efficacy (Krishnakumar & Black, 2003) and poor quality relationships with parenting stress (Gee & Rhodes, 2003; Kalil et al., 2005). Young mothers with supportive male partners are more responsive to their children (e.g., Unger & Wandersman, 1988) and exhibit less hostile-controlling behavior with their children (Florsheim & Smith, 2005). Consistent father contact across the first eight years of children's lives was related to fewer behavior problems and better academic performance for ten-year-old children born to young mothers (Howard et al., 2006). When young mothers received emotional support from the father of their children, their children had fewer behavior problems (Black, 2022).

Studies of how support from family members and partners impacts adolescents' transition to motherhood are few in geographical settings outside the USA but convey considerable variety depending on the cultural and religious acceptance of unwed pimregnancy, norms of patriarchal power within families and respect for older generations, residence patterns, and the nature of subsistence economies. In some contexts,

unmarried pregnant teenagers may be rejected by their communities and families because of strong stigma regarding premarital sex (Asnong et al., 2018). In many settings, particularly in sub-Saharan Africa, it is common, albeit stressful, for young mothers to remain unmarried and living with their families either because the young father of their baby denies paternity or has no means to provide financial support for a child (Anima et al., 2022). Grandmothers and other female relatives become important and warm sources of support and mentorship to many young mothers (Crooks et al., 2022). In many regions, such as in Southeast Asia, premarital sex is taboo or illegal, and many women marry as teenagers, often to older men and often at the direction of their families. Young brides assume a variety of domestic work responsibilities and begin childbearing soon afterward, typically with little support from their spouses and often under the direction of their mother-in-law (Astuti et al., 2020; Klingberg-Allvin et al., 2008). A pregnancy outside of wedlock could lead to a forced marriage or to the shunning of the young woman (Astuti et al., 2020). In regions of extreme poverty, active conflict, and/or political instability, pregnancies may be the result of rape, leading to further shame (Denov et al., 2018).

Perspectives of Young Mothers

The research reviewed thus far provides a view of young parents from the perspective of researchers who have made the decisions about the questions to ask, the topics to be considered, and what developmental trajectories and outcomes are normative and desirable. In contrast, a growing literature, using qualitative research methods, has examined the perspectives of adolescent mothers themselves. That literature provides a richly complex story that, notably, portrays adolescent parenting as a time of personal growth and hope and also highlights some of the challenging aspects of teenage childbearing, including the influence of stereotypes and stigma on their efforts to be good mothers.

Motherhood as a Positive and Transformative Experience

In contrast to the widely held concerns about teenage childbearing as a life course trajectory with a host of negative consequences, reviews synthesizing qualitative research found that, in general, young mothers experience positive life changes and growth as a result of becoming mothers (SmithBattle et al., 2021). Young women find that motherhood provides them with a positive identity that is a source of fulfillment (Anwar & Stanistreet, 2014). Like older women, most young mothers feel a deep and satisfying sense of attachment to their infants (Sommer et al., 2019). Their children are a source of joy, awe, and pride (Cox et al., 2021).

Most adolescents experience becoming a mother as a transition into adulthood (Minnis et al., 2013). They talk about how becoming a mother has changed them to be more mature, responsible, and serious with a sense of purpose (Cox et al., 2021). Becoming a mother often provides them with a strong and even newfound focus on education, whether this means returning to high school after birth, improving their grades, or considering college for the first time (Cox et al., 2021). The child provides mothers with a motivation to achieve an education that will increase their employment prospects, allowing them to support their child. Some are motivated to pursue further education in order to serve as better role models to their children (Clarke, 2015). Even though a large body of research, described briefly in an earlier section of this chapter, has focused on the negative implications of teenage childbearing for educational achievement, the mothers themselves see birth as a time of motivation for education.

For some young women, becoming a mother may be a transformative experience in addition to the arena of education. For some, it is a stabilizing time, during which they become less oppositional and angry, describing a mellowing of a previous "bad attitude" (Cox et al., 2021). For some, it is a time during which they choose to give up bad habits such as drugs and alcohol misuse (Middleton, 2011) and cease engaging in delinquent or other risky behaviors that they see

as inconsistent with being a good mother (Sheeran et al., 2015). The transformative potential is particularly evident for young women at greatest social and economic disadvantage and with the most histories of adverse experiences in their families and communities, including those who had histories of violence and abuse (Williams & Vines, 1999), who have been involved with foster care (Ethier, 2022), who were experiencing intimate partner violence (Bekaert & SmithBattle, 2016), and who were homeless (Meadows-Oliver, 2006). For them, motherhood offers an alternative path for enacting an important adult role (Burton, 1990).

Challenges of Motherhood

Despite the transformative potential of motherhood, young women in the short run often find motherhood stressful, citing the kinds of physical and mental challenges experienced by all mothers of young children related to lack of sleep, babies' demands for attention, and the endless tasks caring for a baby that leaves little time for self-care or socializing with friends (Cox et al., 2021). Most notably, young mothers experience role overload while trying to juggle parenting, school responsibilities, and/or a need to work, often with limited access to reliable childcare (Cox et al., 2021).

In the long run, the accumulation of financial and other challenges young mothers experience not infrequently defeat their goals to continue in school, provide economically for their children, and be good parents (Ellis-Sloan, 2019; SmithBattle et al., 2021). Even though highly motivated, many of the young women speak of the heavy burden they are experiencing in continuing school, recovering from academic disruptions related to pregnancy and birth, but also regarding childcare and time management related to homework, housework, and employment while caring for an infant. Perhaps most importantly, most young mothers had limited financial resources before becoming pregnant which only became more strained after the birth of the child. The exacerbated challenges they face in achieving their goals are deeply rooted in the financial precarity they and their families often are experiencing, a precarity that is reflective of systemic inequalities in education, housing, community resources and safety, and access to social welfare support (Lucas et al., 2019).

Young women who successfully manage the challenges of motherhood usually point to support from families, friends, and partners as important contributing factors (Anwar & Stanistreet, 2014). They describe that supportive relationships, particularly from family, are critical for successful parenting—the difference for thembetween success and failure (Wiggins et al., 2005). The acceptance and protection of their families are powerful forces that lessen stress and increase self-esteem (Lucas et al., 2019).

Experience of Stigma

In studies examining the narratives of young mothers, the experience of stigma is one of the most common themes. Young women are acutely conscious of the societal view that they are too young to be good mothers (Kirkman et al., 2001). This message confronts them through media stories, reality television, and public health campaigns aimed at preventing adolescent pregnancy (Harrison et al., 2016). Young mothers understand that other people believe them to have spoiled their lives and the lives of their children. Young mothers of color experience particularly negative and thinly disguised messages steeped in racism with linkages to sexuality, laziness, and welfare dependence, while portrayals of white middle-class teenage mothers are often more benign (Harrison et al., 2016). The stigma can follow them wherever they go, such as the common experience young mothers have of receiving looks, headshakes, or brief judgmental comments from total strangers in public places (Boath et al., 2013). These experiences leave them feeling as if they are under continuous social surveillance and constantly being judged.

Young mothers also experience negative stereotypes of teenage mothers from the people they interact with in their daily lives, such as family members and peers (Lucas et al., 2019; McDermott & Graham, 2005). These stigmatizing interactions usually take the form of criticism, evaluation, expressions of disappointment,

and mentions of moral failings, but also sometimes involve outright rudeness, mocking, bullying, and hostility. Such interactions provide a pervasive message to young women that they are unfit to be mothers and serve to undermine their self-esteem, mental health, and views of themselves as competent mothers. Young mothers have, to some extent, internalized these negative views, reflected in their embarrassment at letting others know that they are pregnant or parenting (Harrison et al., 2016) or at requesting public aid or other help (Anwar & Stanistreet, 2014).

A growing literature suggests that people in formal helping roles with young mothers—health care providers, teachers, social workers, parent educators, and home visitors—are also influenced by stereotypes regarding teenage mothers that interfere with effective, supportive work. Young mothers report negative experiences with professionals that include being denigrated and discriminated against because of their age, lectured and shamed, and presumed to use drugs or engage in dangerous lifestyles (Conn et al., 2018; Harrison et al., 2017). Healthcare providers treat young mothers with less respect than older patients and assume that they lack the motivation and competence to be good parents (Clemmens, 2003). Sometimes routine procedures such as health and family histories, which are often focused on problems, may be experienced by young mothers as judgmental. In turn, negative, judgmental healthcare encounters contribute to young women not trusting providers, disengaging from services, not asking for help when needed, and even fearing that providers might report them to child protective services due to their age (Harrison et al., 2017). When asked to identify what kind of social services they would find most useful, the most frequent response from adolescent mothers was a desire for relationships with professionals that are respectful and nonjudgmental (Dion et al., 2021).

Mothers who successfully cope with the affront of stereotypes and stigma often do so by keeping an eye on positive goals and trying to prove that others are wrong or that they are an exception (Lucas et al., 2019). As noted above, they devote themselves to parenting and work to construct a positive identity as a "good mother" (Conn et al., 2018; McDermott & Graham, 2005). Some keep a focus on ways in which young mothers excel compared to older women—such as the energy they bring to their parenting (Kirkman et al., 2001). Many cope by actively protesting and resisting negative stereotypes, expressing anger at the unfairness, defending their rights to be a mother, and rejecting stereotypes and even the phrase "teen mom" (Clarke, 2015; Kirkman et al., 2001).

The above studies on stigma were mostly based in North America and the UK, where in recent decades unwed pregnancy has become increasingly accepted. A synthesis of qualitative studies of adolescent mothers in low- and middle-income nations suggests strong sigma in many regions of the world, with adolescent pregnancy being a source of deep shame when it was unplanned, unwanted, out of wedlock, or a result of rape (Crooks et al., 2022). Women felt fear, anger, guilt, and shame at not living up to the expectations of their families and/or bringing shame to them (Coast et al., 2021). Sometimes, societal responses to their pregnancy are harsh, with mothers excluded from further education, from participating in community life, and perhaps even shunned by family (Astuti et al., 2020). Studies of teenage mothers in Africa and Asia suggest that healthcare providers may be rude, disrespectful, and patronizing toward young mothers, occasionally deterring them from seeking further care for themselves and their children (Crooks et al., 2022; Klingberg-Allvin et al., 2008).

Reframing Adolescent Childbearing from a Reproductive Justice Perspective

The research review in this chapter has emphasized that much of how adolescent childbearing has been framed by the public, politicians, and researchers is fundamentally inaccurate or misleading. There has not been an epidemic of teenage pregnancy; the causes of teenage pregnancy are deeply rooted in poverty and structural

inequalities that limit opportunity, including racism; mother's age alone (except in the case of very young mothers) is relatively unimportant compared to social factors and individual and family factors that preexisted pregnancy. Although some teenagers struggle as parents, many are up to the considerable challenges of parenting, find motherhood a meaningful experience, and provide excellent care for their children despite the challenges they experience. They need support to succeed as mothers, and one of their largest challenges to parenting is the stigma and surveillance they experience from society broadly and important people in their lives.

Multiple writers from multiple disciplines have called for a reframing of adolescent childbearing, and there are alternative ways to do so (Anastas, 2017). Within the field of infant mental health, previous reviews of adolescent parenthood have called for a reframing that focus on the diversity of teenage childbearing and a recognition of resilient outcomes for young mothers and their children (Easterbrooks & Katz, 2019; Hans & Thullen, 2009; Luster & Brophy-Herb, 2000). Within this framing, research has focused on identifying which young parents will struggle and which will thrive. This framing has helped the field to better understand how trauma shapes the lives and parenting of young mothers, how mental health struggles can impede young women's parenting, and the critical, but complicated, role of support from family and partners in fostering young women's emotional well-being, parenting, and their young children's development. Such findings help policy and practice to better identify which young mothers are most at risk and in need of services and to understand what types of services might be most appropriate but largely remain anchored in focus on deficits through its focus on risk or resilience in the face of risk.

It is time for the field of infant mental health to reframe adolescent childbearing within a social justice/human rights perspective. The field of infant mental health has only recently begun to engage with issues of social justice and human rights with initiatives such as WAIMH's position paper on the rights of infants (World Association for Infant Mental Health, 2016) and the diversity-informed tenets for the field developed by the Irving Harris Foundation Professional Development Network (Thomas et al., 2019). A social justice perspective that closely aligns with the concerns of infant mental health is the reproductive justice framework (Lauen et al., 2019). Originating among social activists seeking justice for women of color and scholars utilizing critical feminist theory (Ross & Solinger, 2017), the reproductive justice perspective has drawn attention to the ways in which people with marginalized social identities are not allowed to be considered "legitimate" mothers within society. The reproductive justice perspective asserts as tenets the rights of women to have control over their reproductive lives and, most central to the field of infant mental health, women's rights to have children and parent children with support, safety, and dignity (Asian Communities for Reproductive Justice, 2005). The perspective focuses attention on ways in which structural inequalities grounded by legacies of oppression related to race, indigeneity, gender, and in particular their intersection shape women's reproductive lives, family creation, and parenting and work to elevate the voices of marginalized women.

Although others have offered detailed suggestions for how the field of infant mental health can incorporate reproductive justice principles into their work regarding adolescent mothers (Hans & White, 2019; SmithBattle, 2020), this chapter will offer ideas regarding two key topics: (1) the importance of structural factors, social inequities, and bias in shaping and limiting the experiences of young mothers and (2) the importance of dignity and voice for young parents.

Focusing on Structural Inequity and Bias

The field of infant mental health has traditionally been focused at the level of individual parents, individual children, dyads, and families and is not concerned with macro-level social and policy factors policies impacting families with young

children or movements promoting social change (Weatherston & Fitzgerald, 2018). Yet, as mentioned throughout this chapter, young mothers' lives are often deeply intertwined with experiences of poverty, blocked opportunity, violence, and lack of access to basic supports that are available to other women. Across the globe, young women's experiences are embedded in systems of structural inequality and oppression of women, people of color, and the poor. Too often, young women rather than society have been identified as problematic, and solutions have focused on pregnancy prevention rather than eradicating poverty, protecting women from violence, or creating opportunity for young women and their children. The field of infant mental health has been ahead of many other fields in recognizing the toxic effects that adverse experiences, particularly violence in close relationships, can have on parents and young children, but has not yet adequately focused on other kinds of toxic experiences such as structural racism, chronic poverty, and gender-based discrimination against women and girls in education, health, and employment. The field of infant mental health might make more central to its mission, a broader set of goals that address social inequities, such as:

- All girls and young women should have opportunities to thrive emotionally, but also academically, economically, and culturally.
- All girls, women, and young children should be protected from violence, abuse, and coercion within family and from partners, but also protected from structural violence and discrimination based on gender, race, and age within their communities and nations.
- All girls should have information and access to services that allow them to make decisions regarding if and when they will bear children, but also information and access to health services that will allow them to have healthy pregnancies and children.
- All young families should have access to mental health and child development programs, but also to government and private safety nets that support the health, safety, and economic well-being of their families and communities.

To contribute to an equitable and safe world for young mothers, infant mental health professionals need to move beyond their comfort zones to acknowledge and address social inequities affecting young parents and families in poverty. For researchers, this means increasingly attending to macro-level factors in their research questions and study designs, for example, considering young mothers' experiences of racism and bias, more deeply understanding experiences of poverty, better understanding the roles of communities and organizations to the well-being of young mothers and children, and critically examining social policies that impact young families. For practitioners, focusing on social inequities means better understanding young women's experiences of bias and barriers as they navigate education, health, justice, and child welfare systems and advocating for young women within other organizations and systems. Researchers and practitioners need to confront the practices in their work and in their institutions, calling out and changing inequitable policies regarding who is hired to work in organizations and the conditions of their employment, who is offered services, and how those services are offered. Infant mental health professionals need to take an active role in advocating for social policies—those that provide funding for infant mental health services directly (which also pay the salaries of professionals), but also policies that dismantle inequalities and will fundamentally change family experiences. There are numerous important issues that have huge impacts on young parents related to national and local governmental policy regarding health care, nutrition, social welfare benefits, minimum wages and working conditions, environmental toxins, policy and justice system, child welfare system, childcare, housing, and education. Although intended to help vulnerable people, policies or lack of policies in many of these arenas serve to perpetuate social disparities and disadvantages.

Focusing on Dignity and Voice for Young Mothers

The field of infant mental health has traditionally focused on ameliorating or preventing problems in parent mental health, parent-child relationships, and early child development, such as maternal depression, attachment difficulties, parenting stress, and early childhood behavior problems. A predominant focus on problems strips dignity from young mothers. Yet, as reviewed previously in this chapter, most young mothers experience parenthood as deeply meaningful and often transformational in positive ways. When young women are given the opportunity to voice their greatest challenges, they often speak about access to resources and the sense of surveillance they experience and the pervasive stigmatizing messages they receive, including from professionals, that they are unfit to be parents. The field of infant mental health might make more central to its mission, a broader set of goals that offer dignity to young mothers, including:

- Young mothers feel respected for their strength and commitment to the choices they make in becoming mothers.
- Young mothers should feel proud of and respected for the care they are providing their children and for their children's accomplishments.
- When young mothers feel challenged, they should have people to turn to for support who are nonjudgmental and listen to their concerns.
- Young mothers are entitled to information and support that allow them to achieve their goals for their own futures and their children's futures.

Many of the longstanding core tenets of infant mental health are already well aligned with a dignity agenda, including strengths-based and relationships-based perspectives. For researchers, a focus on dignity means attending not only to risks and poor outcomes but also to positive aspects of the development of young women and their children. A focus on dignity also suggests that research designs need to elevate the voices of young women and as much as possible that researchers need to partner with young mothers in deciding what kinds of questions are asked and what kinds of conclusions are drawn from data. For practitioners, a dignity agenda means assuming that young mothers are the experts on their own children and on their own lives, that not all young mothers are alike, and that few young mothers conform to stereotypes. Relationships with young mothers should be built through discussion of their hopes and goals, what they find meaningful in their relationships with their children, and what they find helpful in their relationships with family and professionals. A focus on identifying problems can wait until young women feel respected and ready to trust providers. A core tenet of infant mental health practice is asking questions and deeply listening to standard practice to include topics some practitioners might otherwise ignore, such as mothers' experiences of stigma and how they are managing that stigma. Becoming a parent is a psychologically meaningful time and has the power to transform young women's lives in positive ways. A dignity approach would capitalize on helping young women use that powerful motivation to set goals for continuing their education, planning for careers, and being loving parents, but also to recognize that those motivations can be easily derailed by a variety of challenges and that young women may need support with keeping a focus on their goals. A dignity approach requires that young mothers receive support of the kind they find most helpful—respectful, reliable, fun, and focused on agendas that they establish. Young mothers should not be passive participants in programs, but should be actively involved in discussing what their needs are and what kind of support they would find helpful. Finally, a dignity approach involves helping mothers to become advocates for themselves and their families, including making them aware of opportunities to participate in activities and organizations supporting young parent rights (SmithBattle, 2020).

Summary and Key Points

This chapter reviews the history of how adolescent childbearing came to be framed as a threat to the health and development of young women and their children in the USA and globally. The chapter reappraises this history in line with current research suggesting that the risk for poor outcomes with adolescent motherhood is most accurately attributed to poverty and social marginality that preceded the mother's pregnancy rather than to the mother's age per se. Research documents a wide range of outcomes for young mothers and their children and that those with adequate economic resources and social supports do well. Most adolescent mothers experience parenthood as challenging but also as a positive and growth-promoting experience that often transforms their lives in positive ways. The framing of adolescent motherhood as a social problem has led to young mothers feeling stigmatized and surveilled and has undermined their emotional well-being and efficacy as parents.

This chapter also suggests reframing adolescent childbearing within a reproductive justice framework that acknowledges the role of structural inequities and bias in shaping the lives of adolescent mothers and their children and that respects the dignity of young mothers by elevating their voices. Adopting a reproductive justice perspective challenges the field of infant mental health to make social justice a priority and to take time to reflect on their beliefs, actions, and inactions within research and practice. We have learned throughout our lives, including during our professional training and socialization, a set of negative stereotypes regarding young mothers. These are stereotypes that do harm to and take power away from those we intend to help. Systems of oppression are not immediately visible to those of us with the privilege that comes from being white, affluent, and/or credentialed as a professional; awareness requires concerted, sustained, and sometimes difficult effort. Fortunately, the field of infant mental health has a long history of reflective practice that can be redirected to thinking about the biases and blind spots we bring to our work regarding young parents.

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22

Parental Sexual Orientation, Parental Gender Identity, and the Development of Young Children

Charlotte J. Patterson

Many lesbian, gay, bisexual, transgender, and queer (LGBTQ) adults want to become parents, and many have succeeded in doing so (Patterson & Riskind, 2010; Reczek, 2020; Riskind & Patterson, 2010; Riskind & Tornello, 2017; Simon et al., 2018). Many lesbian and gay adults have children who are biologically linked to them, and others have adopted children or become foster parents (Farr et al., 2020b; Perrin et al., 2019) According to data from national surveys in the USA, more than 100,000 LGBTQ couples are currently rearing children under 18 years of age (Goldberg & Conron, 2018), and this is almost certainly a significant undercount. Continued controversy about parenting by LGBTQ adults does, however, remain (Patterson et al., 2021). Research on LGBTQ parenting and on their children's development addresses questions at the center of public discussion and is summarized in this chapter.

In the context of controversies about LGBTQ parenting, this chapter provides an overview of both early and recent research studies. Much of the work addressing sexual and gender minority parent families has focused on lesbian and/or gay parents, so much less is known about parenting by those with other sexual and gender minority identities, such as bisexual, transgender, and nonbinary parents (Goldberg et al., 2014a; Lamb, 2012; Moore & Stambolis-Ruhstorfer, 2013; Patterson, 2017). For this reason, the discussion below will focus mainly on lesbian and gay parents and on their children. Wherever possible, however, research on parents who identify as bisexual, transgender, or other related identities and their children will also be included.

This chapter views the research on LGBTQ parents and their young children through interdisciplinary and intersectional lenses. Studies of LGBTQ parenting have emerged primarily from psychology, but research from social work, family science, demography, sociology, and other disciplines has also been important. For this reason, the body of work emerging from all of these disparate fields is considered, as well as that from psychology. In addition, most research on LGBTQ parenting has focused primarily on parental sexual and gender identities (Fish & Russell, 2018). In this review, where possible, other intersecting identities, such as race, class, and legal or policy contexts, are considered. It should be acknowledged from the outset, however, that studies focused on people of color and on those living in poverty have been relatively scarce (Reczek, 2020). Within these contexts, then, the research on LGBTQ parents and their children is presented below. Throughout the chapter, both similarities and differences among LGBTQ and cisgender heterosexual parent families are considered.

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Given that research on these topics began in the English-speaking world and developed for many years in that context—for example, in the USA and in the UK—the discussion will focus mainly on research findings from these parts of the world. The importance of the legal and cultural contexts of family lives must nevertheless be recognized. There has been a recent explosion of research on LGBTQ parenting from around the world in legal and cultural contexts that vary in many different ways, and a brief summary of the results of this work will also be presented. This will be followed by conclusions and discussion about directions for future research.

Early Controversies and Research About LGBTQ Parenting

For many years, parenting by LGBTQ adults has generated controversy, both in the USA and around the world (Golombok, 2015; Lamb, 2012; Patterson, 1992, 2006, 2009; Patterson et al., 2021). In this regard, research and law have been intertwined. For instance, the ways in which lesbian and gay parents have historically been discriminated against in US courts of law have provided one important impetus for research. At the same time, research has played a significant role in support of legal change over time. Because they form a significant part of the context of LGBTQ parenting, some of the major legal policies in the USA relevant to sexual and gender minority parents are identified briefly, together with a few of the ways in which research may have informed recent legal judgments.

In the context of widespread assumptions about the inherent superiority of traditional heterosexual parent family structures, many observers predicted that children of lesbian or gay parents would suffer from a number of problems (e.g., Baumrind, 1995; Falk, 1989; Hitchens & Kirkpatrick, 1985). For instance, lesbian and gay parents were seen as inappropriate role models for children and as unlikely to succeed in parental roles. Moreover, it was expected that children would be teased, harassed, and rejected by their peers and that this would cause psychological problems. It was also argued that the children of lesbian and gay parents might show atypical gender development. Some observers wondered if children might even grow up to be lesbian or gay themselves, an outcome that—from a heteronormative perspective—was generally considered to be negative (Falk, 1989).

Unproven assumptions were behind many discriminatory laws that, for many years, had negative effects on lesbian and gay parents and on their children. In some parts of the USA, parents were denied custody of their children, and prospective parents were denied the opportunity to adopt children; in some jurisdictions, second parents in same-sex couples were also denied the possibility of legalizing adoptions for children they had reared from birth (Ball, 2012; Patterson, 1992, 1995; Rivers, 2013). Since most of the negative ideas were in essence empirical hypotheses, however, they also gave rise to research that was designed to evaluate them (Goldberg & Allen, 2020; Golombok, 2015; Lamb, 2012; Patterson, 1992, 2000, 2006, 2017).

In an important example of the early research, Golombok et al. (1983) studied 5- to 17-year-old children of divorced lesbian mothers, comparing them to same-aged children of divorced heterosexual mothers. Their study revealed no significant differences in children's gender development, behavior problems, emotional difficulties, peer relations, or social development as a function of parental sexual orientation; moreover, children's adjustment was not associated with parental sexual orientation (Golombok et al., 1983). Many other researchers published similar results in studies of divorced lesbian mothers, divorced gay fathers, and women who had children after coming out as lesbian (see reviews in Patterson, 1992, 2000, 2017). As research findings of this kind began to reach the general public as well as the courts, and as public attitudes began to shift (Patterson et al., 2020), judges began to render different kinds of decisions. Over time, the legal situation of lesbian and gay parents in the USA gradually grew more favorable (Ball, 2012),

Significant decisions relevant to sexual orientation and parenting were made in courts across the country, and at least some of these were

informed by research findings. One important decision from the US Supreme Court was Lawrence v. Texas (2003), which overturned so-called sodomy laws across the country. Sodomy laws, which forbade oral or anal sex, and in some states made consensual same-sex sexual behavior into a felony offense, had often been used to characterize lesbian and gay parents as criminals, and thus unfit to be parents (Ball, 2012). After the *Lawrence* decision, this was no longer possible, and it became more difficult to deny LGBTQ parents custody of their children. Another landmark decision was Obergefell v. Hodges (2015), which legalized same-sex marriages across the country. Among other effects, the *Obergefell* decision opened up expanded legal recognition of parentage, such as stepparent adoptions, in families headed by same-sex parents. In many such cases, questions about parenting and children were prominent, and many observers have remarked that the findings of social science research seemed to play a role in informing decisions (e.g., Ball, 2012; Falk, 1989; Rivers, 2013; Shapiro, 2020).

In the USA today, the marriages of same-sex couples are recognized by law in all the states. A child born to two married same-sex parents is presumed to be the legal child of both parents, regardless of the presence or absence of genetic links. In all 50 states, married same-sex couples are allowed to petition for stepparent or joint adoption so that both petitioners can be recognized as a child's legal parents (Shapiro, 2020). Where once there was widespread discrimination, such that lesbian or gay parents were often at risk of losing custody of their children in the courts, the law now protects the marriages and children of same-sex parents.

One way in which legal discrimination against lesbian and gay parents is still a reality, however, is in acceptance of so-called "religious exemptions." Even in jurisdictions that have nondiscrimination laws in place, some religiously based child welfare agencies have argued that religious beliefs justify negative treatment of sexual minority parents or prospective parents. Several states (e.g., Kansas, Georgia, and Oklahoma) have passed legislation that allows state-licensed child welfare agencies to refuse services to prospective sexual minority foster and adoptive parents based on their religious beliefs (Movement Advancement Project, 2018). In Fulton v. Philadelphia (2021), despite the presentation of empirical evidence about the damage that it was likely to cause, the US Supreme Court allowed a religious exemption to stand. The decision was, however, narrowly framed and may not be widely applicable, but this remains to be seen (for further discussion of this case, see Patterson & Farr, 2022).

Thus, for many years, research and law about lesbian and gay parents and their children have been closely connected, and the changing legal situation has formed an important part of the context of LGBTQ parenting in the USA (Patterson, 1995, 2009). Even as research has contributed to legal change (Gilfoyle & Dvoskin, 2017), controversies surrounding the parenting of young children by sexual minority adults have prompted research about the capabilities of lesbian and gay adults as parents, about various outcomes for children reared by lesbian and gay parents, and about overall family interactions and processes in such families. This research is discussed below.

Transition to Parenthood

In this section, findings of research on how LGBTQ adults become parents, their strengths and challenges, and outcomes for children and parents are presented. In some ways, LGBTQ parents have experiences that are very similar to those of other parents (e.g., learning to respond to toddlers' tantrums), but they also face some issues that are specific to their circumstances (e.g., questions about which member of a lesbian couple should become pregnant). In what follows, both of these types of issues are considered.

Pathways to Parenthood

LGBTQ adults become parents in many different ways (Bos & Gartrell, 2020; Patterson & Riskind,

2010; Perrin et al., 2019; Tornello & Bos, 2017). Some have children in the context of a heterosexual marriage that later dissolves when one or both partners come out as LGBTQ; after divorce, a non-heterosexual or transgender parent may then take on either custodial or non-custodial roles for children (Stotzer et al., 2014). Others pursue pathways to parenthood that include adoption, donor insemination, and surrogacy, either alone or in relationships with same-sex partners. Each of these pathways is considered briefly below.

One pathway through which some non-heterosexual people become parents is adoption. LGBTQ adults may adopt children for reasons that are both similar to, and distinct from, those of cisgender heterosexual adults (Goldberg, 2012; Mallon, 2011; Tornello & Bos, 2017). In Farr and Patterson's (2009) study of adoptive families in the USA (about half of whom had lesbian or gay parents and about half heterosexual parents), virtually all couples gave "wanted to have children" as a reason for pursuing adoption, regardless of parental sexual orientation. The majority of heterosexual couples reported "challenges with infertility" as another motivation for adopting children, but fewer than half of same-sex couples reported this. On the other hand, many more same-sex than other-sex couples reported that they "did not have a strong desire for biological children." In other studies, with US samples of lesbian and heterosexual adoptive couples, lesbian women have also proven less likely than heterosexual women to report a commitment to biological parenthood (Goldberg et al., 2009; Goldberg & Smith, 2008; Jennings et al., 2014). Some transgender adults have also described adoption as a preferred pathway to parenthood (Dickey et al., 2016; Farr & Goldberg, 2018; Stotzer et al., 2014; Tornello & Bos, 2017). Thus, LGBTQ adoptive parents seem to be more likely than heterosexual parents to have chosen adoption as their first-choice route to parenthood (Mallon, 2011).

LGBTQ adults may also be more willing than their heterosexual peers to adopt a child from a racial-ethnic background different than their own. Among preadoptive couples, lesbian couples have been found to be more open than heterosexual couples to transracial adoption (Goldberg, 2009a). Other investigators have also reported that both lesbian and gay adoptive couples are more likely than heterosexual adoptive couples to have completed a transracial adoption (Farr & Patterson, 2009; Lavner et al., 2012; Raleigh, 2012). However, in one study of lesbian, gay, and heterosexual adoptive parents, there were no significant differences in the likelihood of completing a transracial adoption as a function of sexual orientation (Brodzinsky & Goldberg, 2016). Thus, discrepancies in completion rates for transracial adoptions by lesbian, gay, and heterosexual couples warrant further study. In one study, transgender adults were also especially open to adopting older children or those who are transgender (Goldberg et al., 2020a). This too may be an area for further research.

One reason that LGBTQ couples in the USA may be particularly willing to adopt transracially is that same-sex couples are themselves more likely than heterosexual couples to be interracial, and, in turn, interracial couples are more likely than same-race couples to complete transracial adoptions (Farr & Patterson, 2009; Raleigh, 2012). Indeed, LGBTQ parents tend to live in communities with considerable racial diversity within the USA (Gates, 2013), which may increase levels of comfort in interracial interactions. In part, because they are often less committed than heterosexual couples to achieving biological parenthood, LGBTQ couples may be more open than heterosexual couples to considering transracial adoptions (Dickey et al., 2016; Farr & Patterson, 2009; Goldberg et al., 2009; Jennings et al., 2014).

Another way that LGBTQ adoptive couples may differ from heterosexual adoptive couples is in terms of gender preferences in adoption. Goldberg (2009b) studied lesbian, gay, and heterosexual couples in the USA who were seeking to adopt, and reported that while heterosexual men were unlikely to express a gender preference, gay men often preferred to adopt boys. Lesbian participants who expressed a preference generally preferred to adopt girls, as did the heterosexual women in the sample. Similar findings

have emerged from other research conducted in the USA and in Europe regarding preferences for child gender among lesbian, gay, and heterosexual adoptive couples (e.g., Baccara et al., 2014; Herrmann-Green & Gehring, 2007).

What might account for gender preferences? In one study, many lesbian and gay adoptive parents explained their preferences for child gender by reference to concerns about gender socialization (Goldberg, 2009b). Some participants reported feeling uncertain about parenting a child whose gender was different than their own. It is possible that lesbian and gay couples, being composed of two parents of the same gender, may have felt uncertain about their ability to parent a child of a different gender. Even though the results of research do not sustain such ideas, heterosexual couples may be less likely to question their ability to parent a child of either gender since one parent of each gender is represented in the parenting couple.

Research has also begun to explore the views of adoptive families in the USA about the nature and amount of contact between adoptive and birth families, which is often referred to as "openness" in adoption (Farr & Goldberg, 2015). Available evidence suggests that, as compared to heterosexual adoptive parents, same-sex adoptive parents may be more open to contact with birth relatives (Goldberg et al., 2011) and may report more positive relationships with them than do heterosexual couples (Brodzinsky & Goldberg, 2016). As more and more adoptions are characterized by some degree of openness, further research on this topic would be valuable.

Of course, many LGBTQ people choose to have children via methods that yield a biological connection between parent and child. Sexual minority women may choose to use techniques associated with assisted reproductive technology such as donor insemination, and sexual minority men may choose to pursue surrogacy. These pathways raise questions for same-sex couples that are not usually relevant for heterosexual couples. For instance, which woman in a lesbian couple should become pregnant? Which man in a gay couple should donate sperm and thus become biologically linked with a child born via surrogacy? These are important questions, but despite some anecdotal reports, not much is known about how these decisions are made or about the consequences (if any) of different decisions. Moreover, due to legal and financial constraints, it should be acknowledged that these pathways are not available to all who might otherwise wish to pursue them.

Less is known overall about transgender parents and their children, as compared to lesbian or gay parents, but some information is available (Stotzer et al., 2014). Grant et al. (2011) reported on results of the National Transgender Survey, which involved more than 6000 participants, from across the USA, and found that 38% of transgender adults described themselves as parents. Those who had transitioned later in the life course were more often parents, suggesting that many children had been born in the context of heterosexual relationships prior to transition. Consistent with this notion, others have reported that most transgender and nonbinary parents report having had children to whom they are biologically linked (Tornello et al., 2019). Transwomen (i.e., those who had been assigned male at birth and later transitioned to female identities) were more likely to describe themselves as parents than transmen (i.e., those who had been assigned female at birth and later transitioned to male identities) (Grant et al., 2011; Hafford-Letchfield et al., 2019). Additional research on transgender parenting—especially on the transition to parenthood among transgender adults who become parents after transitioning—would be valuable (Grant et al., 2011; Tornello & Bos, 2017).

Transition to Parenthood

Regardless of parents' gender or sexual identities, the transition to parenthood brings both new pleasures and distinctive challenges. When couples become parents, there is a period of adjustment that can be marked by stress and compromised mental and physical health as well as by excitement and joy (Cowan & Cowan, 1992; McKay et al., 2010). Consistent with the

broader literature on the transition to parenthood, Goldberg et al. (2010) found that among lesbian, gay, and heterosexual adoptive couples in the U.SA, relationship quality declined across the transition to parenthood; this was true for all types of couples. Women reported the greatest declines in love, and those in relationships with women (i.e., both heterosexual and lesbian partners) reported the greatest ambivalence. In another study based on data from the same sample, Goldberg and Smith (2009) also found that, regardless of sexual identities, most parents reported increases in perceived parenting skill across the transition to parenthood.

In a longitudinal study examining factors affecting lesbian and gay adoptive couples across the transition to parenthood, Goldberg and Smith (2008, 2011) found that greater perceived social support and better relationship quality were associated with more favorable mental health for all couples. Sexual minority parents who had higher levels of internalized homophobia (i.e., negative feelings about their own sexual minority identities) and who lived in areas with unfavorable legal climates reported the largest increases in anxiety and depression across the transition to parenthood. In this research, the factors that contributed most to parental well-being during the transition to parenthood were the presence of social support and other variables related to family processes, not the parents' sexual or gender identity (Goldberg et al., 2014b; Lavner et al., 2014; Sumontha et al., 2016).

With the birth or adoption of a child, one important set of decisions that parents must make involves the choice of the child's names. In their study of lesbian, gay, and heterosexual adoptive parents in the USA, Patterson and Farr (2017) found that heterosexual couples were more likely than lesbian or gay couples to follow patriarchal conventions in naming their children. Thus, whereas children of heterosexual parents were most likely to have been given the last names of their fathers, children of lesbian or gay parents were more often given hyphenated last names that had been created by combining the last names of both parents. Thus, same- and other-sex couples in this study took different approaches to naming their children (Patterson & Farr, 2017). Little additional information is available about the naming of children by sexual and gender minority parents, and this is a topic that might benefit from further study (see Pilcher, 2017).

It is worth noting that the transition to parenthood has been studied more carefully among some LGBTQ parents than among others. In particular, the special issues of LGBTQ couples becoming parents through surrogacy have as yet received less systematic study than others. Like the experiences of adoptive parents in some ways (e.g., neither intended parent has given birth), they are nevertheless very different in other ways (e.g., one parent is often genetically linked with the child, while the other is not). Despite a handful of studies of gay men's transition to parenthood in families formed via surrogacy (e.g., Bergman et al., 2010; Golombok et al., 2018a), transitions to parenthood among same-sex couples using surrogacy are still relatively little studied.

Research on Infant and Child Development

In controversies surrounding LGBTQ parenting, the debate has often centered on child development (Golombok, 2015; Patterson, 2000, 2017). Questions have been raised about whether LGBTQ adults are likely to provide infants or children with adequate parenting and effective socialization. Research has focused especially on children's attachment relationships with their parents and on their behavioral and gender development.

Attachment Relationships with Parents

One area of interest has involved the nature of attachment bonds between children and their parents (Sroufe, 1978; Sroufe & Waters, 1977). Attachment theory suggests that responsive caregiving is instrumental in the establishment of secure attachment relationships between children

and their parents and also that secure relationships lead to positive developmental outcomes for children (Sroufe & Waters, 1977). Thus, an important question has been to what extent do children of lesbian or gay parents develop secure attachments to parents?

An early study of this issue was reported by Golombok et al. (1997). These investigators studied 6-year-old children; 30 had lesbian mothers, 42 had single heterosexual mothers, and 41 had two heterosexual parents. Children reared from infancy in "fatherless families" (i.e., with lesbian or single heterosexual mothers) experienced warmer interactions with mothers and were more securely attached to mothers than were those in "father-present families" (i.e., those with heterosexual mothers and fathers). There were few differences between children in the lesbian and single-mother families, but those with lesbian mothers had more social interaction with their mothers than did those with solo heterosexual mothers.

Qualities of attachment relationships among preschoolers adopted by gay couples in Canada were studied by Fuege' et al. (2020). On average, the children were just under four years of age and had been living with their fathers for almost three years. Parental sensitivity and child attachment security were assessed using the Waters and Deane (1985) Q-sort methodology. Results showed that average scores for fathers were high on sensitivity, and average scores for their children were high on attachment security. As predicted by attachment theory, correlations between paternal sensitivity and child attachment security were significant, and securely attached children showed fewer behavioral problems. Moreover, child attachment security scores did not differ significantly from those in normative samples of same-aged children (Fuege' et al., 2020). These findings highlight the sensitivity of care provided by adoptive gay fathers and the positive developmental trajectories of their children.

Similar findings have been reported with young children by Salinas-Quiroz and colleagues (Salinas-Quiroz et al., 2018, 2022). In one paper, Salinas-Quiroz et al. (2018) reported case studies of 18-month-old and 3-year-old children with lesbian and gay parents in Mexico. In a later study, also conducted in Mexico, Salinas-Quiroz et al. (2022) examined the development of attachment among 1- to 6-year-olds with lesbian or gay parents. In both studies, the use of Q-sort methods revealed both highly sensitive parental behavior and high levels of child security. Moreover, as predicted by attachment theory, parental sensitivity was strongly associated with the security of children's attachment relationships.

Similar findings have also emerged from research with older children and adolescents. For example, Carone (2022) studied the security of attachment among 6- to 12-year-olds with gay or heterosexual single fathers, all of whom also had non-parental caregivers, such as grandparents, aunts, or uncles. Results revealed that children's attachment security did not vary as a function of paternal sexual orientation (Carone, 2022). Carone and colleagues (2020) also studied 6- to 12-year-old surrogacy children with gay fathers and compared them with same-aged donor-conceived children with lesbian mothers, reporting high scores for security of attachment among children with gay fathers that did not differ from those of children with lesbian mothers or from scores of a large group of children with heterosexual parents. Similar findings have also been reported among older children and among adolescents who were adopted by lesbian, gay, and heterosexual parents (Erich et al., 2009; McConnachie et al., 2020).

Thus, the accumulated evidence suggests that parental sexual orientation is not a significant predictor of children's security of attachment. It appears that children of lesbian and gay parents are likely to experience sensitive parenting and are likely to develop secure attachment bonds. No studies of the qualities of attachment among children with bisexual, transgender, or nonbinary parents have yet been reported. These gaps in knowledge suggest areas for future research.

Behavioral and Gender Development in Early Childhood

In childhood, children of LGBTQ parents show behavioral and gender development that is similar to development among those with heterosexual parents (Biblarz & Stacey, 2010; Moore & Stambolis-Ruhstorfer, 2013; Patterson, 2013, 2017). Studies of LGBTQ parent families, especially those focusing on young children's behavioral adjustment and gender development, are reviewed below. Studies of parenting, couple relationships, parent-child relationships, and family systems during early childhood are also discussed. Results of these studies are unusually clear, and they indicate that parental sexual orientation is not a strong predictor of individual or family outcomes. Other factors, such as the qualities of parenting and family relationships, as well as prevailing attitudes and laws in a family's environment, seem to be more important. On the other hand, the largest amount of research has focused on school-aged children, adolescents, and young adults, and there are fewer studies on infants or young children.

Behavioral adjustment has been a topic of great interest in studies of child outcomes in families with lesbian or gay parents. Early studies (e.g., Golombok et al., 1983) focused on internalizing or externalizing behavior problems as a function of parental sexual orientation and found school-aged children of lesbian mothers to be generally well-adjusted. Golombok and her colleagues (2014, 2018a) studied lesbian, gay, and heterosexual parent families with young children and reported that youngsters with lesbian and gay parents were actually less likely than those with heterosexual parents to show externalizing behavior problems. Similarly, in their longitudinal study, Gartrell and her colleagues (2000, 2005) reported that 5- and 10-year-old children with lesbian mothers showed no more behavior problems than would be expected based on national norms for children with heterosexual parents. These and related data revealed that school-aged children with lesbian and gay parents develop well, with behavioral adjustment that was at least on par with that of children with heterosexual parents (Chan et al., 1998; Goldberg & Smith, 2013).

Research has also examined children's gender development over time in families headed by lesbian, gay, and heterosexual parents. Several studies reported no differences in young children's gender development as a function of parental sexual orientation (Brewaeys et al., 1997; Fulcher et al., 2008; Golombok et al., 2003). More recently, among adoptive families with lesbian, gay, and heterosexual parents, no significant differences as a function of parental sexual identities were found in parents' reports or in observational data on preschoolers' gender development. Across family types, children showed preferences for toys and activities typical of their gender (Farr et al., 2010a, 2018). Moreover, these findings were consistent over time—child and parent reports, in addition to observational data from early to middle childhood, revealed that children's behavior was conventionally gender-typical and that gender development was similar across family types (Farr et al., 2018). In another study, Goldberg and Garcia (2016) examined lesbian, gay, and heterosexual parents' reports of their children's gender-typed play behavior in early childhood. Children of lesbian mothers were less likely to demonstrate gender-typical play behavior compared to children of gay and heterosexual parents across multiple time points. This could be attributed to sexual minority parents being more likely to display attitudes about gender that were flexible (see Fulcher et al., 2008). Overall, however, it seems that parental sexual orientation is not a strong predictor of children's gender identity or development; rather, most of the findings suggest that factors such as parents' attitudes and especially behaviors may be more significant.

Some studies of families with lesbian and gay parents have examined outcomes for parents and couples, as well as for parent-child relationships and overall family functioning. Patterson (1996) found that, on average, a sample of lesbian mothers who had children of different ages showed good mental health, and Chan et al. (1998) also reported this. Similarly, Goldberg and Smith (2011) reported very few depressive symptoms

among a sample of lesbian and gay adoptive couples with preschoolers. In a study focusing on the parenting experiences of gay fathers, Tornello et al. (2011) found that lesbian, gay, and heterosexual participants' reports of parenting stress were well within the normative range. Farr et al. (2010a) also found that lesbian, gay, and heterosexual parents of young children in their sample of adoptive families reported relatively little parenting stress, with no significant differences as a function of family type. Moreover, studies examining parenting stress over time among samples of lesbian, gay, and heterosexual parents have found that parenting stress was not generally associated with sexual orientation (Farr, 2017b; Goldberg & Smith, 2014; Lavner et al., 2014; Van Rijn-von Gelderen et al., 2018). Lesbian, gay, and heterosexual parents have also been found not to differ in their use of effective parenting techniques, with no significant differences in effectiveness as a function of parental sexual orientation (Farr et al., 2010a; Golombok et al., 2018b). In observational data on family interaction, lesbian, gay, and heterosexual adoptive parents were found to be relatively warm and accepting with their children overall; regardless of sexual orientation, mothers acted in warmer ways with their children than did fathers (Farr & Patterson, 2013). As in most other work in this area, the majority of individuals studied here have been white and economically secure; exploration of the extent to which findings are consistent across race, ethnicity, and economic status could be an important direction for future research.

In terms of couple relationships among lesbian and gay adoptive parents, Goldberg and Smith (2009) found that absolute levels of relationship conflict reported by lesbian and gay adoptive couples were relatively low. Interestingly, Goldberg et al. (2018) found higher conflict among individuals who had plurisexual identities (i.e., bisexual and queer) as compared to those with monosexual identities (i.e., lesbian and gay). In terms of additional couple relationship dynamics, Farr et al. (2010a) found that adoptive parents reported high average levels of couple relationship adjustment with no significant differences across parental sexual orientation. A majority of parents reported long-term relationships with their partners or spouses, in which they felt secure and satisfied (Farr et al., 2010b). Lesbian and gay parents in this sample also reported overall satisfaction with current divisions of childcare labor, which participants generally described as being shared by both parents in the couple—both when children were in early childhood and in middle childhood (Farr & Patterson, 2013; Sumontha et al., 2017).

When considering the extent to which couples may break up, the research findings are not yet entirely clear (Farr et al., 2020a). In a study of lesbian, gay, and heterosexual parent families, Goldberg and Garcia (2015) reported no differences in the proportions of couples who divorce as a function of sexual orientation. There have, however, been reports of higher rates of relationship dissolution among lesbians than among other parenting couples (e.g., Farr, 2017a; Gartrell et al., 2011; MacCallum & Golombok, 2004). For example, Farr (2017a) reported that 30% of lesbian couples in her sample had separated over a period of several years, a larger number than in either of the other two groups. These reports come from relatively small samples, however, and they were recorded during a time of great legal and social change. Thus, lesbian couple relationships may be at higher risk of dissolution, but continued attention to factors that influence relationships among LGBTQ parents seems to be warranted (Farr et al., 2020a, b).

Consistent with findings from the broader literature (cf. Golombok, 2015; Patterson, 2017), the quality of parenting and parent-child relationships has been more influential than parental sexual orientation in determining individual outcomes. Many studies have reported this finding (e.g., Chan et al., 1998; Erich et al., 2009; Golombok et al., 2014, 2018a; Wainright et al., 2004). For instance, in their study of families headed by lesbian, gay, and heterosexual adoptive couples in the USA, Farr et al. (2010a) found that qualities of family interactions were more strongly associated with outcomes among young children than wasfamily structure. Across all families, positive parenting, harmonious couple

relationships, and healthy family functioning were associated with parents' reports of fewer child behavior problems both in early and middle childhood (Farr, 2017b; Farr et al., 2010a). Drawing on data from the same sample, Farr and Patterson (2013) found that the observed quality of coparenting interactions was related to children's behavioral adjustment, such that more supportive and less undermining behavior between parents was associated with fewer child behavior problems. Thus, associations between parental sexual orientation and child, parent, or family outcomes have consistently been weaker than those between family processes and these outcomes.

Little is yet known about the children of transgender or nonbinary parents. The extant research findings are based mostly on a few small samples but have suggested that most transgender parents tell their children directly about their transition and that this news is received in a neutral or positive way by most children (Veldorale-Griffin, 2014). When parents transition early in the children's lives, one study found that children seem to show better adjustment (White & Ettner, 2007) and another found no difference in children's adjustment (Imrie et al., 2021). Overall, children and their transgender parents have been found to have strong relationships, and children have been found to show positive adjustment (Imrie et al., 2021). Negative responses by children to a parent's transition do occur, however, and if they are going to emerge, they seem to come more often from adolescent or adult children rather than younger ones (Grant et al., 2011). Clearly, more research on transgender and nonbinary parents and their children would be helpful.

International Perspectives

Most research on LGBTQ parents and their children has been conducted in the USA, UK, and other English-speaking nations, but there has been a major increase in research from other parts of the world over the last several years (Costa & Shenkman, 2020; Patterson et al., 2014). The largest amount of this work has come from Europe—from France (e.g., Gross, 2009; Gross & Richardot, 2020), Belgium (e.g., Brewaeys et al., 1997), Spain (e.g., Gonzalez & Lopez-Gavino, 2022), and the Netherlands (e.g., Bos et al., 2007). Research has also, however, emerged from Asia (e.g., Brainer, 2019, 2021), the Middle East (e.g., Erez & Shenkman, 2016; Shenkman & Shmotkin, 2014), Africa (e.g., Breshears & Lubbe-DeBeers, 2014, 2016), and Latin America (e.g., Salinas-Quiroz et al., 2018). A few studies have compared the experiences and adaptation of LGBTQ parents and their children across different national boundaries (e.g., Costa & Salinas-Quiroz, 2018; Shenkman et al., 2021).

As has been true in the USA and in the UK, the diverse and rapidly changing social, legal, and cultural contexts in which this research has been conducted have proven to be intertwined with the nature of the research itself. For instance, Costa and Shenkman (2020) observed that recruitment of large samples can be very difficult in environments where sexual minority identities are extremely stigmatized. For this reason, such environments may not be conducive to large-scale quantitative research. Not surprisingly, then, much of the research emerging from Africa and the Middle East employs qualitative methodologies with small samples of participants. Further, the nature and meanings of sexual identities themselves may vary across contexts and cultural groups. For these and related reasons, comparisons of findings across national borders can often be difficult to make.

When comparisons of findings across national boundaries have been made, however, they have generally supported earlier findings. For example, Shechner et al. (2013) compared 6-year-old children of single and coupled lesbian versus heterosexual mothers in Israel and found that children of single mothers showed more externalizing behavior problems than others, but maternal sexual orientation had no negative effects. Indeed, children of lesbian mothers reported more prosocial behavior and less loneliness than didthose with heterosexual mothers. Thus, consistent with earlier findings, children with lesbian mothers in Israel were at least as well adjusted as those with heterosexual parents (Shechner et al., 2013).

In some cases, comparisons across national boundaries have allowed a glimpse of cultural factors that might otherwise have escaped notice. In a recent study, Shenkman and his colleagues (Shenkman et al., 2021) examined the desire for parenthood as a function of sexual orientation among childless young adults in three different nations. Two of the countries—Israel and Portugal—were considered by the authors to be strongly pronatalist, while the third—the UK—was described as less pronatalist and more characterized by individualistic values. Consistent with the contexts in which they lived, results showed that Israeli and Portuguese participants expressed a greater desire for parenthood than did their peers from the UK. Across all three national contexts, however, heterosexual participants expressed a greater desire for parenthood than did LGBTQ participants who lived in the same country. Thus, cultural as well as personal characteristics were strongly associated with young adults' views about family formation.

Another approach to the understanding of social and cultural factors in this area is to study individuals who are exposed to more than one set of such values. In a recent study of this kind, Li and Patterson (2022) examined views of the future, including views about parenthood, among Chinese young adults who were studying as international students in the USA. Consistent with the findings of other research, sexual minority students were less likely than heterosexual students to report a desire for parenthood. For all students, however, the perceived impact of Confucian teaching was positively associated with parenting aspirations, regardless of sexual orientation. Also independent of sexual orientation, those who described themselves as more affected by American ideas about individualism were less likely to report aspirations for parenthood. Thus, cultural ideas as well as personal characteristics were significantly associated with students' views about family formation (Li & Patterson, 2022).

Much remains to be learned about the ways in which sexual identities and experiences are shaped by law, custom, and culture, both within and across national boundaries. Attitudes and laws about sexual orientation have been changing around the world, most often—but not always—in the direction of liberalization (Flores & Park, 2018). In some nations, conservative and even reactionary ideas have gained traction in recent years, yielding even more unfavorable climates for members of sexual and gender minorities (Flores & Park, 2018). As has been the case in the USA and other Western countries, future research and activism relevant to sexual and gender minorities seem likely to be intertwined with global social, cultural, and legal change. In describing and understanding such changes, there is much for social scientists to learn.

Summary and Key Points

In the USA, some LGBTQ adults are parents, and many more want to have children. In their efforts to become parents, LGBTQ adults have reported facing numerous obstacles and experiencing many kinds of discrimination. Significant changes in the cultural and legal context in recent years, such as the legalization of marriages for same-sex couples in the USA, have, however, placed parenthood within the realm of possibility for ever larger numbers of LGBTQ people. Research has revealed that, once having overcome obstacles to parenthood, LGBTQ mothers and fathers are at least as capable and effective as are heterosexual parents. Quality of parenting and quality of family relationships—not parental sexual orientation or gender identity—have emerged as the best predictors of children's adjustment. Thus, as in other types of households, family processes appear to be far more central than family structure to child outcomes and to overall family functioning among LGBTQ-parent families (Golombok, 2015; Lamb, 2012; Patterson, 2017). Early research on these topics was conducted largely in the English-speaking world, but replications of the principal findings—as well as some new insights—are also emerging in many other parts of the world.

The impact of research findings being brought to bear on popular opinion and on legal decision-making has been associated with real changes in

the social and legal context of LGBTQ people's lives, particularly in the USA (Gilfoyle & Dvoskin, 2017). Whereas LGBTQ people were once disadvantaged in many ways, LGBTQ people are now able, as equal citizens, to share in the legal and economic protections of marriage. This in turn has begun to make it more possible for LGBTQ people to consider parenthood. LGBTQ people still show less inclination than do others to become parents (Patterson & Riskind, 2010), but the gap between heterosexual and sexual minority people in this regard may be shrinking, both in the USA and in many other nations of the world (Costa & Shenkman, 2020).

In view of contemporary concerns about the replicability of psychological research (e.g., Nosek & Errington, 2020), it is worth acknowledging the degree to which findings on this subject have been replicated. Major findings—for example, about the successful development of children with lesbian and gay parents—have been replicated multiple times, by many investigators, using different methods, diverse samples of participants, and in many parts of the world. Results that emerged initially from research conducted in the USA and the UK have now also been reported by researchers in Belgium, Italy, the Netherlands, and other nations. This offers reason to believe that the basic findings are sound.

The quality and consistency of findings in this field have made them particularly valuable in legal contexts. Major findings about LGBTQ parents and their children have been replicated many times, and they have been brought to the attention of courts in the USA via expert witness testimony and in amicus briefs, such as those offered by the American Psychological Association (Gilfoyle & Dvoskin, 2017). In this way, findings of research on LGBTQ parents and their children have been made available in courtrooms across the country. More recently, the research evidence in this area has also been important in informing policy changes in other nations.

The growth of international research on lesbian and gay parents and their children has not only resulted in important replications of major findings, but has also engendered a renewed appreciation of the importance of social and cultural issues (e.g., Brainer, 2021). In a recent study conducted in Israel, Portugal, and the UK, for example, the role of dominant ideologies was made visible in that both LGBTQ and heterosexual adults in Israel and Portugal were more likely to desire parenthood than were their counterparts in the UK (Shenkman et al., 2021). The importance of expectations about the ways in which gay parent families might be received in particular social contexts has also been documented among prospective gay fathers in Italy (Baiocco & Laghi, 2013). Further research that focuses on the social and cultural conditions in which LGBTQ prospective parents are living, and on how these affect family lives, could make important contributions to knowledge in this field.

An important conclusion to draw from this body of research is the remarkable resilience that has been shown over the years by many LGBTQ parents and their children. Even with challenges from stigma and from discriminatory treatment, many prospective LGBTQ parents have found ways to form families of their own. Even in the face of persistent heteronormative doubts, questions, and disapproval, many LGBTQ parents and their children have found ways to thrive. The ability to create families is, after all, a fundamental human right, and research in this field has revealed how, despite obstacles, LGBTQ people have increasingly been able to claim it.

Future Research Despite the growing amount of research in this area, some issues remain relatively unstudied. Diversity among LGBTQ parents is one such issue (Moore, 2011; Reczek, 2020). It will be important for future research to study racial, ethnic, cultural, and economic issues that affect the qualities of lives among LGBTQ adults and their children around the world (Brainer et al., 2020; Goldberg et al., 2020b; Moore, 2011). Sexual and gender minority individuals name themselves in an increasing variety of ways (e.g., pansexual, demisexual, polyamorous, and nonbinary), and research is needed to understand the impact, if any, of these new identities on experiences among families (Manley & Ross, 2020). Attention should be paid to the real

strengths as well as the definite challenges of these families (Coontz, 2020). Future studies would also do well to employ a variety of research designs and methodological approaches to collect data from multiple sources (Fish & Russell, 2018). In these ways, a more comprehensive and well-rounded understanding of LGBTQ parenting can emerge.

As research continues, it will be important to keep bringing its findings to the attention of those who shape the laws and policies under which LGBTQ people and their families live. Significant issues that loom in the USA may include various aspects of child welfare law and policy, such as those that affect adoption and foster care (Patterson et al., 2021; Patterson & Farr, 2022), as well as issues related to assisted reproductive technology, such as those that influence the availability of surrogacy and other forms of family formation (Cahn, 2012). These and other issues (such as legal recognition for same-sex marriage) are also likely to be important in other nations in the coming years, and it will be helpful if empirical data from social science research can be brought to bear on policy debates focused on these matters.

Conclusion In conclusion, sexual and gender minority parents are growing both in numbers and in visibility around the world. Researchers have documented both some of the challenges endured by and some of the successes achieved by LGBTQ parents and their children. Indeed, research has shown LGBTQ parents and their children to be remarkably resilient against many challenges posed by heteronormativity and related ideas. Much remains to be learned, however, about the many ways in which the lives of LGBTQ parents and their children are shaped by the differences among them and by the qualities of the environments in which they live. In the end, such knowledge should help to enable the creation of contexts that allow more and more of these and other families to thrive.

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Mentalizing in Infancy and Early Childhood

23

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Mentalizing, or the ability to understand and interpret behavior in terms of underlying mental states, is an evolutionarily selected (Tomasello, 2019), pre-wired, and neurologically distinct capacity in humans (Fehlbaum et al., 2022; Gilead & Ochsner, 2021). However, mentalizing is an adaptive behavior that is also subject to environmental influences. In this chapter, we will focus on mentalizing in infancy and consider how it unfolds across infancy and interacts with other social–cognitive processes. We will begin by briefly setting out the basic framework of mentalizing theory and its relevance for understanding some of the key developmental processes in infancy and early childhood and then describe the developmental trajectory for the emergence of mentalizing in the first years of life. We will also consider what we know about mentalizing in terms of developmental outcomes and developmental psychopathology, how early experiences affect mentalizing capacity, and what the impact of this might be on later outcomes. Finally, we will suggest how mentalizing can help our understanding of the task of parenting and inform possible clinical (and societal) approaches to supporting parents and infants in the work of learning to mentalize one another.

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The Mentalizing Framework

Perhaps one of the most important points to emphasize is that mentalizing is not really one thing. We have described it as an "umbrella concept" (Luyten et al., 2020a). Mentalizing envelops a wide range of related concepts, including empathy, mindfulness, theory of mind (ToM), psychological mindedness, and insightfulness. These concepts can be grouped into those that focus on mentalizing others (e.g., empathy and ToM) and those that focus on mentalizing the self (e.g., mindfulness and alexithymia) (Choi-Kain & Gunderson, 2008). Mentalizing is also a dynamic process that can be influenced by stress and arousal, which might, for example, drive a switch from controlled, reflective mentalizing to automatic, biased mentalizing.

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The Mentalizing Dimensions

The artificial boundaries between social, emotional, perceptual, and cognitive processes are difficult to maintain as heuristically all these domains intertwine in continuous streams of thought. One way in which the mentalizing umbrella has been segmented is via neurobiological and behavioral research suggesting that mentalizing can be organized into four dimensions or polarities, each with its own likely underlying neural circuits. Each dimension has a developmental course and follows paths from a more behavioral to a more mentalistic processing level. We suspect that in people whose capacity to mentalize is vulnerable, a shift toward the pole(s) that is/are less demanding of mentalistic process may be inevitable. Effective mentalizing is thought to be associated with the capacity to flexibly move along these dimensions in response to environmental cues. Difficulties can arise when someone tends to be stuck on one end of a dimension. As we will explain in more detail below, at some point, all parents will inevitably "get stuck" in non-mentalizing ways of experiencing themselves and their child. Yet, parents at increased risk for psychopathology are more vulnerable to such imbalances in mentalizing.

Automatic–Controlled Mentalizing The first dimension is *automatic* vs *controlled* mentalizing. Automatic mentalizing involves reflexive processes that require little effort and is supported by older neural circuits that rely on sensory information. Controlled mentalizing, on the other hand, is conscious, verbal, and reflective and is supported by newer brain circuits that use linguistic and symbolic processing. We appear able to make a small number of mindreading inferences quickly and automatically, but fall back on a second ability that may be effortful but is malleable enough to deal with the complexity of the average social situation (Apperly, 2021). On the fast path, we simply assume on the basis of accumulated experience that a behavior is intentional because it looks (is configured) like other actions we have seen (Decety & Cacioppo, 2012; Malle & Holbrook, 2012).

Automatic, or implicit, mentalizing developmentally antedates controlled, or explicit, reflection. Human infants as young as 6 months give implicit evidence of awareness of an agent's false belief by looking where they expect the agent (based on their false belief) to look (Kovacs et al., 2010). It is suggested that automatic and controlled mentalizing share core brain areas but also that controlled attributions may lead to a modulation in some additional brain areas, perhaps reflecting a correction or an enrichment (Van Overwalle & Heleven, 2021).

Automatic mentalizing and controlled mentalizing are important for stress and emotion regulation. In situations of increased stress or arousal, there is a shift from controlled mentalizing to automatic mentalizing (Lieberman, 2007; Mayes, 2006). The fight-or-flight response that arises in response to a threat relies on fast, automatic processing of threatening information. However, in complex social situations, automatic responses can generate difficulties and may result in nonreflective, overly simplistic, and biased assumptions about the self and others. Challenges in the interpersonal world can be particularly difficult for individuals with low levels of effortful control or a history of insecure attachment, which may both contribute to differences in the capacity for controlled mentalizing (for more on the relationship between attachment and mentalizing, see section "The Role of Parental Mentalizing").

In relation to the care of an infant, we perhaps expect too much of parents when it comes to their capacity for automatic mentalizing. The assumption that there exists an unerring "maternal instinct" that makes caring for a baby instinctive and reflexive can be experienced as a potentially punitive imperative. In fact, the task of looking after a baby involves a particularly demanding combination of these two capacities – the ability to respond to the infant on an "instinctive" level in order to mirror the child's experience back to them and also to reflect on the child's experience in such a way as to ensure that such parental responses are not overwhelming.

Internal–External Mentalizing Externally focused mentalizing relies on external cues such

as body language, facial expression, or tone of voice to identify thoughts and feelings, while internally focused mentalizing involves inferring mental states (looking behind what is observable) through perspective-taking or contextual imputations. Looking behind what is externally available and observable is of course the strength of sophisticated mental state inference, which allows us to see through pretense, conceit, irony, and deception (Malle, 2021). When mentalizing processes are limited, looking behind (looking inside) becomes problematic and the obvious becomes the sole choice.

The challenge for parents of infants, and particularly so in the first months of life, is that a baby does not clearly differentiate or represent internal states and is therefore unable to communicate them – physical and affective phenomena for a baby are best understood as a powerful blur of experience. Much of the work of parenting is trying to decipher the external cues that a baby gives out and to locate the source of distress or the focus of interest/desire, whether that be externally or internally caused or both at the same time.

Cognitive–Affective Mentalizing The cognitive aspects of mentalizing consist of the ability to take another's perspectives and to understand their behavior based on their desires and beliefs. The affective aspects of mentalizing involve grounding in a felt emotional reality. While cognitive mentalizing relies on controlled processes, affective mentalizing is largely automatic and embodied (Sabbagh, 2004). Along similar lines, models of empathy divide empathy into two factors: emotional empathy, which entails feeling the emotions of others, and cognitive empathy, which refers to understanding others' thoughts, beliefs, and motivations (Cuff et al., 2016). Excessive cognitive mentalizing can become a form of pretend mode thinking (described below), in which thoughts and feelings can be discussed and described but without any genuine emotional core. Affective mentalizing, on the other hand, involves feeling the mental states in a way that is necessary for any real empathy and emotional connection. However, a parent who is stuck in an extreme form of affective mentalizing may become over-sensitive and over-reactive to an infant's emotional states in a way that can spiral into becoming overwhelming and catastrophic.

Self–Other Mentalizing Research suggests that mentalizing developed as an adaptation to the growing need for mutuality and cooperation. When in 1989 we defined mentalizing as equally applicable to understanding actions in the other and in the self, there was minimal sympathy with this approach outside the psychoanalytic community. Mentalizing was about inferring the mental state of the other, and the mental state of the self was assumed to require separate or no elaboration. Yet, the ability to infer one's own mental state is not a given; indeed, it is a process that may be mentalistic or less so depending on the quality of "self-focused mentalizing" (Maresh & Andrews-Hanna, 2021) (alternatives are "self-referential thought," "self-reflection," "private self-consciousness," or even "introspection").

We might assume that mentalizing the self calls on very different processes from mentalizing others. After all, we have access to multiple aspects of our internal experience, such as physiological states, affective reactions, and memories, all of which need to be inferred when considering others (Damasio, 2010; Varela et al., 2017). However, as the processes implied by mentalizing are gradually elaborated, it is also becoming more evident that how we understand the mental states of others and how we reflect on ourselves are probably fundamentally and deeply interconnected (Gerace et al., 2017; Oosterwijk et al., 2017; Saxe, 2015).

Effective mentalizing assumes that the distinction between self and other can be maintained while at the same time allowing for a subtle cross-referencing of the two perspectives: joining, comparing, discriminating, and controlling the outcome of this mentalizing activity, so one does not displace the other by activating the opposite response from the one intended. Given that the neural networks activated when reflecting

on the self or others overlap (Beeney et al., 2016; Tan et al., 2022), this is hardly surprising. In relation to parenting and infancy, it may be that the parent temporarily loses their capacity to self-mentalize, often in the face of the infant's attachment needs or distress, and in so doing, the parent may also lose their capacity for self-regulation. The infant and the parent's emotions become undifferentiated and overwhelming for both parties. At the other end of the self–other spectrum, a parent who is perhaps depressed and preoccupied may lose their ability to think about the mental state of the child. It may be easier not to think of the infant as even having mental states or reduce them to highly simplistic ones ("my baby is just very greedy and selfish") that lose sight of the needs and experiences of the infant.

When Mentalizing Breaks Down

Breakdowns in adaptive mentalizing typically give rise to non-mentalizing modes of experiencing the self and others. These are understood as ways of functioning that emerge when an individual's capacity for mentalizing has broken down, and they fall back on ways of seeing themselves and others that do not meaningfully or realistically engage with mental states.

We distinguish three such modes. In the *psychic equivalence* mode, thoughts and feelings are considered to be unshakably real and individuals are unable to consider perspectives other than their own. They believe that their own perspective is the only possible one, reflecting a domination of the self over others, external experiences over internal experiences, and emotions over cognition. In a young child, this quality of psychic equivalence can be seen in the tendency to assume that their mental states are shared and understood by all. In a state of psychic equivalence, a parent who is feeling overwhelmed and experiencing self-loathing might, for example, assume their baby is also hostile and judgmental toward them.

In the *teleological mode,* only observable, goal-directed behavior and externally discernible events that may potentially constrain these goals are recognized, reflecting an extreme focus on external experiences and a momentary loss of controlled mentalizing. Again, in a young child, this might manifest in a need to express or receive affection via physical contact, or indeed anger or upset via acts of hitting or throwing, etc. In a parent, the teleological mode might be observed in the assertion that "there is nothing wrong with my infant, and he has been fed and has a clean diaper" or the belief that a baby who is not crying cannot have any other needs or interests.

In the *pretend mode*, thoughts and feelings are disconnected from reality, leading to endless cognitive narratives that have no connection to reality and can cause feelings of derealization and dissociation. This mode is characterized by the domination of implicit, inadequate internal focus over explicit mentalizing, poor belief-desire reasoning, and a vulnerability to fusion with others. Certain kinds of imaginative play are the preeminent example of pretend mode in children, particularly those involving narratives or enactments of agents in imagined scenarios; this distinction between play and reality that children exhibit in normative play is lost or muddled in adults operating in the non-mentalizing pretend mode. An example of this in parenting might be witnessed in a parent's over-elaborate, perhaps hostile descriptions of their young baby's state of mind: "She is crying like this to wind me up because she knows exactly how to play me and get what she wants."

When these pre-mentalizing modes of experiencing subjectivity reemerge in later childhood, adolescence, or adulthood, this is often associated with a pressure to externalize unmentalized aspects of the self, also known as "alien self" parts. The idea of the alien self is, clinically, often used in relation to both self-harm and violence toward others. The concept captures the process by which emotional experiences are experienced with a painful intensity that causes mentalizing to fail and results in a complete loss of a coherent sense of self (Rossouw & Fonagy, 2012). This fragmentation causes such pain and further collapse of mentalizing that extreme or violent acts are felt to provide a form of release or protection. The particular salience of the alien self in relation

to infancy is twofold. The first is the understanding that something like the alien self is a normal experience in infancy – babies and young children have a limited capacity for self-regulation, and if an experience of distress is not attended to with the help of another, it can become overwhelming. Something of this experience was conveyed in Winnicott's description of the infant's sensation of "going to pieces" in a state of "unthinkable anxiety" (Winnicott, 1962, p. 58). One of the challenges of parenting is responding to the child's distress/anger when in this state and retaining the capacity to mentalize both oneself and the infant in the face of powerful affect. The second way in which the alien self is important in infancy may be in recognizing its presence and the seriousness of its implications in parents. Individuals whose capacity to think and to self-regulate tends to fragment in the face of overwhelming effect may need particularly active support or intervention in relation to their caregiving responsibilities.

Embodied Mentalizing

We have increasingly recognized that what is loosely referred to as embodied mentalizing – literally the embodiment or bodily expression of interpersonal understanding – is a vital part of both the emergence of mentalizing (Debbané et al., 2016; Shai & Fonagy, 2013) and its connection to and facilitation of secure attachment (Gagné et al., 2021; Shai & Belsky, 2011a, b).

The concept of embodied mentalizing is particularly salient to infancy, as Shai and Fonagy have described: "Because an infant's mind is very much based on bodily processes, actions and kinesthetic feedback, a parent's embodied mentalizing is the chief means of achieving a meeting of minds with the infant." (Shai & Fonagy, 2013, p. 191). Parental embodied mentalizing refers to the parent's capacity to implicitly conceive, comprehend, and extrapolate the infant's mental states from the infant's movement and expression and adjust their own bodily responses accordingly. Of the four mentalizing domains, the dominant ones in embodied mentalizing are automatic, affective mentalizing, as opposed to cognitive and reflective mentalizing. A highly productive program of research has shown synchrony to be a form of co-regulation between infants and mothers (Feldman, 2021), the infant learning from the mother mechanisms for managing emotions in relation to their social interactions. Physical mimicry of emotion has a clear role in empathy. Seeing one's own emotions mirrored in another may relieve distress through generating a sense of feeling understood, activating the ventral striatum and middle insula – brain regions associated with reward and attachment (Morelli et al., 2014). The way we would frame these insights would be to conceptualize physical interaction as a form of communication.

Research on the impact of caregivers' embodied mentalizing is emergent. One of the first studies (that we know of) of parental embodied mentalizing in relation to infants reported two interesting findings. The first was that embodied mentalizing and mind-mindedness (a measure of mentalizing that focuses on what the parent verbalizes to and about the infant) were positively correlated. Second, it was found that embodied mentalizing predicted secure attachment over and above the role of mind-minded speech (Shai & Meins, 2018). Another study similarly found that sensitivity and verbal and embodied mentalizing were positively associated with one another; further, parental embodied mentalizing had a significant indirect effect on infant attachment security, mediated by sensitivity. Interestingly, verbal mentalizing did not have such an effect (Gagné et al., 2021). Further, an intervention study of 39 mothers and infants found that embodied mentalizing in infancy significantly predicted language development 12 months later and marginally predicted child cognitive development (Shai et al., 2022).

The Role of Parental Mentalizing

The fact that infants are not yet fully fledged mentalizers has important implications for the task of parenting. The first issue relates to the mentalizing pressure that is placed on parents

given their infant's pre-mentalizing state. The dilemma for parents of infants is that, particularly when they are in the exclusive company of their child, they are effectively in a "non-mentalizing social system," or, more accurately, a pre-mentalizing social system (Baradon & Campbell, 2022). Parents with a strong capacity to mentalize can hold in their mind the two ideas, which can be difficult to sustain, that an infant has mental states but does not fully mentalize (i.e., does not yet understand that their own mental states are not necessarily shared or understood by all, that others may feel differently, that there may be differences between their beliefs and reality, and that they may at times feel desperately upset but this does not mean they are going to fall to pieces, etc.). Most parents, perhaps particularly when feeling exhausted, stressed, or unsupported, may at times lose the capacity to hold both these ideas in mind but, to varying degrees, are able to recalibrate themselves to the mentalizing imbalance that characterizes the parent–infant relationship.

Although infants cannot mentalize, they can be – and need to be – mentalized. Indeed, mentalizing theory proposes that being mentalized is a vital developmental experience. The mentalizing model proposes that although babies cannot mentalize, the grown-ups around them treat them *as if* they can mentalize. This constant process of interacting in a way that attributes valid and separate mental states to the baby supports the infant's nascent mentalizing capacities. The mother or father (or grandparents, caregivers, or siblings), in their day-to-day actions, perform an active task: they make sense of the mental space inside the infant, for the infant.

We have some evidence of the impact of parental mentalizing in relation to both child attachment and child mentalizing outcomes. In the attachment domain, one of the earliest studies of reflective functioning found that antenatal mentalizing predicted attachment at 1 year and 18 months (Fonagy et al., 1991) and in fact remained a predictor of young adult mentalizing capacity 17 years later (Steele et al., 2016). The capacity of parents to mentalize their child as being associated with secure attachment is indicated by a recent meta-analysis investigating the effect of parental mentalizing on attachment security. Using 20 effect sizes from a total of 974 participants, the authors reported a pooled correlation of $r = .30$ between parental mentalizing and infant attachment security (Zeegers et al., 2017).

Medium-to-large effect sizes (Cohen's $d = .50–.80$) have been found for the relationship between parental and child mentalizing (for a review see Luyten et al., 2020a). For example, Rosso and Airaldi (2016) found a strong association between mothers' ability to mentalize negative and mixed-ambivalent mental states, but not positive mental states, and their adolescent children's corresponding ability ($r \approx .40–.50$). These findings suggest that caregivers' ability to reflect on difficult and emotionally charged mental states is particularly important for the transmission of mentalizing. The impact of parental mentalizing on infant mentalizing is also indicated by findings that pre-natal mind-mindedness is associated with more frequent infant-initiated conversations at 7 months (Foley et al., 2022). In addition, parental and child mentalizing in early childhood has also been linked with both cognitive and emotional functioning more generally (Bernier et al., 2017; Hughes et al., 2017), emphasizing that the development of cognitive and socioemotional abilities are closely intertwined in childhood.

Since the first exploration of this developmental approach, we have considered contingent responsiveness to be a key part of emotion regulation via emotion understanding (Fonagy et al., 2002; Gergely & Watson, 1996). Responding to emotion contingently in terms of time, tone, and content is an aspect of interpersonal interaction, which developmentally scaffolds progressively developing awareness and understanding of affective states by allowing the infant to identify their own reaction in the contingent response of the observer. It is vital that the response is more than imitation or mimicry to enable the infant to find themselves rather than the observer in the observer's response. Marked mirroring moves beyond reinforcing the emotional response by simple replication (it is unhelpful for a mother to burst into tears in response to the child's cry) and

offers a partial model of the baby's emotion while clearly signaling that the observer is not feeling the full force of that affect state. Rather, the observer indicates that they are able to reflect on the baby's expressive display and place it in context – perhaps decreasing its intensity, combining it with indications of coping, integrating it with other (incompatible) emotions, and enabling questioning, inquisitiveness, and curiosity. This is empathy beyond imitation; it is a reflection that also "looks behind." Contingency (mimicry, mirroring, and imitation) is a critical component of empathic engagement, but without markedness, it would risk aggravating rather than soothing because it would fail to present the opportunity for activating (or creating) a second-order or symbolic representation of the baby's physical affective experience.

Studies on mentalizing and adversity also provide evidence for the potential role of caregivers' mentalizing abilities in child development. Early adversity and complex trauma (i.e., early negative life experiences involving neglect and/or abuse, typically within an attachment/caregiving context) can severely impair mentalizing, resulting in biased mentalizing, hypersensitivity to others' mental states, defensive inhibition of mentalizing, or a combination of these features (Borelli et al., 2019; Luyten & Fonagy, 2019). Growing evidence indicates that high levels of caregivers' reflective functioning, particularly with regard to their own traumatic experiences (Ensink et al., 2017), can serve as a protective factor for the children of parents who have experience adversity (Berthelot et al., 2015; Borelli et al., 2019). These findings have important implications for prevention and intervention, and highlight the need for more direct tests of the assumed role of parental mentalizing in the relationship between parent attachment history and child outcomes (Zeegers et al., 2017).

Social Learning and Epistemic Trust

One of the results of exposure to consistently non-mentalizing caregiving experiences is that joining up with other minds in the "we-mode" is hard to achieve – other minds are regarded as aversive, or they may be simply unreachable owing to the individual's own inability to mentalize the self and/or other people. Co-mentalizing, another way of describing the we-mode, is dependent on individual mentalizing. We have described this as a somewhat recursive process of mentalizing in which the individual needs to be able to a) mentalize themself accurately, in order to b) mentalize the other accurately enough to understand how the other is seeing them, in order to c) discriminate whether or not their perspectives align. In other words, it is dependent on a reasonable, reliable, and accurate representation of both one's own and the other's mental states (Fonagy et al., 2021). It has been suggested that when this process is achieved, an "epistemic match" is experienced, and the channel for the communication of knowledge and understanding is opened (Fonagy et al., 2021). This thinking is based on the application of the concept of epistemic trust to thinking about mental disorder and developmental psychology. The idea was partly developed out of the clinical experience of working with clients who, often diagnosed with borderline personality disorder (BPD), were traditionally regarded as "hard to reach" and experienced high levels of distress and difficulties in social functioning (Fonagy et al., 2015). Intriguing research has indeed indicated that individuals with BPD tend to be resistant to reframing interventions in the wake of exposure to a hypothetical negative experience (Nicolaou et al., 2023). It was suggested that such individuals' experiences could perhaps be understood in terms of a disruption in their capacity for epistemic trust (Fonagy et al., 2015). In addition to being based on clinical practice with adults diagnosed with BPD, this thinking is also based on the work of developmental researchers (Csibra & Gergely, 2006, 2009, 2011), who have argued that human infants possess an innate predisposition to learn from others, but that this openness to learning is dependent on cues from the "teacher" that they recognize the agency and separate selfhood of the infant. Thus, a parent or carer who mentalizes the infant – showing an active engagement and investment in the child's mind – is, by

that very process, also conveying to the infant that they are someone who is interested in communicating useful social knowledge to the child. Such an infant can drop their natural epistemic vigilance (Sperber et al., 2010) and expect what the other person tells them to be relevant with generalizable value when it comes to navigating the social world (Fonagy et al., 2017a, b).

One of the consequences of relational trauma is that the child's capacity for epistemic trust may be undermined (Luyten et al., 2020b). A child who has experienced early adversity may come to regard their caregiver as unreliable in what they communicate about the world; they may even perceive their communications as outright ill-intentioned. This is a natural adaptation, but as an entrenched position, it can leave the individual resistant to new learning and unable to benefit from social communication, and they may appear rigid because they treat new knowledge from the communicator with deep suspicion.

The transmission of information from parents to children, as well as between peers, constitutes a core mechanism of adaptive cultural learning but can also cause maladaptive behaviors that typically first emerge in infancy and early childhood, such as antisocial actions, exaggerated avoidance, and anxiety (Espinosa et al., 2021). The development of mentalizing intricately relates to social learning and our unique human ability to learn from others by trying to understand what they have to teach us. Infants quickly learn to infer a model's goal and copy successful (but not failed) actions – but actually primates acquire this capacity earlier than humans. By age 3, children start showing what is called overimitation; young children readily learn novel subefficient means from social models (Hoehl et al., 2019). For a period, they are prone to copy the behavior and acquire the beliefs of the majority unselectively and unreflectively (Lyons et al., 2011) and copy a model's failed as well as successful attempts (Huang et al., 2006), which other primates never do (Clay & Tennie, 2018). The reasons for this are obvious. Relatively inefficient routines are frequently socially transmitted as part of cultural knowledge shared by members of a child's community (Clay & Tennie, 2018). Acquiring such routines is therefore an important developmental task for children to become members of their cultural group. The term does not signify that children imitate knowledgeable adults when they should not. Rather, the tendency to "overimitate" cognitively opaque actions is a cultural learning strategy presumably identified through natural selection based on the assumption that such sub-efficient means should be imitated precisely because they are evaluated as culturally relevant (despite their opacity to the learner) (Altınok et al., 2020). Preschool children's detailed mimicking of new behaviors may represent an openness to learn novel skills, unusual social norms, and rituals and thus to affiliate with members of their community (Nielsen, 2018). Overimitating declines as mentalistic understanding emerges but remains part of culture since a comprehensive understanding of causation is beyond us even in the physical world. The predisposition to overimitate is sustained into the adult years (Flynn & Smith, 2012), and is correspondingly enhanced by social context (Gruber et al., 2019; Marsh et al., 2019).

Trust impacts on learning on a number of levels. Studies of learning through observations demonstrated that even learning about basic threat and safety information is improved when the information is transmitted by individuals from the same positively connoted racial group (Golkar et al., 2015) or from individuals with whom the learner declared a cultural identification (Golkar & Olsson, 2017). Learning has been shown to be enhanced by similar neuronal responses (interpersonal neural alignment of inferior frontal cortices) between demonstrator and observer (Pan et al., 2018). Similarity of neural firing indexes mutual liking (Parkinson et al., 2018), suggesting that a sense of proximity or jointness is encoded and monitored in shared social action. Studies looking at autonomic activity (e.g., skin conductance) similarly suggest that the degree of autonomic synchronicity as well as self-rated empathy predicted vicarious learning from the observed agent (Parnamets et al., 2020). Deliberately manipulating mentalizing in a learning context, instructing the learner to adopt the perspective of the instructor, showed that

encouraging state empathy by perspective-taking improved vicarious threat learning even when tested in the absence of the demonstrator (Olsson et al., 2016). It seems that in observational learning, social characteristics of the instructor/demonstrator in the direction of broadly interpreted proximity affect learning outcome. In general conditions favoring mentalizing, clearer inferences about others' thoughts, feelings, and dispositions, and greater affective sharing, favor the process of information acquisition.

There are various ways in which the theory of epistemic trust can be brought into thinking about infancy. The first way is in recognizing that some of the parents who may need support in caring for infants seem hard to reach in this way. A richly mentalizing experience may be a common factor in effective treatment – no matter what form the psychotherapeutic intervention takes (Bateman et al., 2018). It has been suggested that there are three overlapping stages, or "communication systems," at work in effective treatment. The first communication system, shared by all models of therapy, involves the therapist explaining their model for understanding the mind in a way that the patient can understand and feels recognized by. The accuracy with which, in this process, the therapist shows they understand the client's state, and can relate it meaningfully to their model, serves as a rich cue indicating to the client that they can relax their epistemic vigilance. Communication system 2 involves the reemergence of the patient's capacity for mentalizing, beginning with an interest in and exploration of the therapist's mind and their own. Communication system 3 takes place outside the confines of the consulting room. At this stage, the patient, because of their relaxed vigilance and increased mentalizing, is able to apply what they have "learned" in therapy to relationships and social systems outside therapy, improving social function and supporting ongoing change. Communication system 3 can emerge only if the patient is operating within a sufficiently benign social milieu that supports mentalizing and epistemic trust (Bateman et al., 2018).

The communication systems, as outlined in this mentalizing model, are applicable to working with parents and children, with certain caveats. System 1 needs to not only convey the therapist's understanding of the parent's mind but also work at keeping the baby as central to the model and the process. A parent who is struggling with caring for their baby may feel particularly defeated and lacking in agency, and one of the tasks of helping may involve communicating to the parent their emotional agency and the therapist's own interest in the parent's mind, both in its own right and in relation to the baby. Similarly, communication system 2 involves working together to support the mentalizing of the parent in relation to the baby as well as in relation to the parent's own states and their states in relation to the therapist. Responding to the baby's communications and supporting the interaction between parent and infant will provide signals for the relaxation of epistemic vigilance for the baby.

Communication system 3 is perhaps particularly important for the parents of young children. The improved mentalizing that has, hopefully, been stimulated can be hard for parents to sustain. As mentioned above, the pre-mentalizing states of infants, combined with the emotional and practical demands of parenting young children, can place considerable strain on a parent's own capacity to mentalize. This takes us to the next development in the mentalizing model, a closer attention to the social environment around the family, which we will discuss in the section "Implications for Prevention and Intervention."

Empirical Evidence for Mentalizing Interventions in Infancy and Early Childhood

There are several MBT interventions for infancy and early childhood, ranging from preventive interventions for children and parents at risk (such as the Minding the Baby program) through broad interventions for symptomatic children (including MBT for children) and more specialized combined prevention and treatment interventions such as the Reflective Fostering Programme.

Minding the Baby (Sadler et al., 2013; Slade et al., 2020) is a mentalizing-based home visiting program that starts during pregnancy and continues until the child's second birthday, and targets that help at mothers living in low-income urban settings who often are exposed to significant and chronic environmental difficulties including poverty, social isolation, and poor education, and typically also have to cope with personal histories of abuse and depression (Longhi et al., 2016). The Minding the Baby team includes a nurse or health visitor and a social worker who are both highly trained and supervised in particular techniques and developmental approaches tailored for working with vulnerable young mothers. The Mothers and Toddlers Program (Suchman et al., 2010) and Mothering from the Inside Out (Suchman et al., 2017) consist of 12 weeks of mentalizing-based individual parenting therapy as an adjunct to outpatient substance abuse treatment. Minding the Baby is a longer-term intervention; Mothers and Toddlers and Mothering from the Inside Out are briefer programs.

The Lighthouse Programme specifically focused on parents of infants at risk of maltreatment (Byrne et al., 2019). The Lighthouse Programme is a 20-week intervention designed to increase parental mentalizing, focusing on attachment and child development outcomes. Parents attend a weekly Lighthouse MBT Parents' Group, facilitated by two MBT practitioners, and fortnightly one-to-one MBT-Parenting sessions with an individual therapist. The Lighthouse Programme is undergoing extensive evaluation, and it is hoped that it will prove to be an evidence-based intervention that is highly scalable and relatively brief, allowing for a valuable new intervention for more vulnerable families.

One systematic review of MBT for children, adolescents, and families has found that of 14 studies focusing on infancy and early childhood, 13 of the studies measured changes in parental reflective functioning as an outcome and 11 found improved reflective functioning as measured using the Parental Development Interview (Slade et al., 2004; Byrne et al., 2020). A systematic review and meta-analysis of the impact of early dyadic interventions targeting the parents of infants and toddlers found a nonsignificant but moderate effect size for improved parent reflective functioning in the intervention group and a significant reduction in disorganized attachment. There was no evidence for intervention effects on attachment security, parent–infant interaction, parental depression, or parental global distress (Barlow et al., 2021). Four of these six studies involved mentalizing-based interventions. The other two studies included in this meta-analysis involved relational interventions focusing on parents' representations (Fonagy et al., 2016; Sleed et al., 2013). More research is therefore needed to investigate the effectiveness of early MBT interventions.

In addition, improving the parent's capacity to reflect on the child's mental state is a core part of many early interventions for parental and early childhood problems. Various interventions are aimed at improving parental sensitivity, particularly those using video feedback techniques. In meta-analytic studies of interventions aimed at improving parental (usually maternal) sensitivity, those that include feedback to the parent based on videos of parent–infant interaction turned out to have the largest effect sizes (Bakermans-Kranenburg et al., 2003; O'Hara et al., 2019). The intervention for positive parenting using video feedback (VIPP) is one of the treatments most commonly tested in high-risk samples (mothers with mental health diagnoses, insecure maternal or child attachment, and children with behavioral problems) and has been shown to benefit parental attachment security, parental sensitivity, child attachment security, and behavioral problems. It demonstrated effectiveness in improving parental sensitivity, increasing parent–child attachment security, and reducing child behavior problems (Juffer et al., 2017; O'Farrelly et al., 2021). There is additional evidence for other parent–infant interventions that make explicit use of the reflective functioning construct to increase mentalizing in parents of relatively small infants, including Watch, Wait, and Wonder (Cohen et al., 2002), Parent–Infant Psychotherapy (Fonagy et al., 2016), Circle of Security (Cassidy

et al., 2017; Risholm Mothander et al., 2018), and Parent–Child Relationship-Based Interventions (Mortensen & Mastergeorge, 2014). Descriptions and supporting evidence for these interventions are more fully reviewed elsewhere in the handbook.

Implications for Prevention and Intervention

Social support for parents is – in MBT terms – the oxygen without which parental mentalizing simply cannot be expected to sustain itself. A study tracing individual levels of mentalizing – operationalized as mindedness – from the third trimester of pregnancy through to 24 months postpartum found modest stability overall, which is indicative of the way in which mentalizing capacity interacts with the environment. However, significant gains in mentalizing were associated with mothers who had equal access to childcare and higher socioeconomic status, with infant surgency, and in fathers with daughters, and, in keeping with the theoretical proposition that mentalizing leads to further mentalizing, similar gains in mentalizing were found within couples (Foley et al., 2023). Further evidence of the importance of the wider environment in supporting maternal mentalizing has been found in a study of the impact of cumulative stressful contexts (CSC, in the form of infant prematurity and household chaos) on maternal mentalizing and behavior, which found a mitigating effect for CSC. It was found that mentalizing was related to higher sensitivity and triadic relations in low-stress contexts, but in high-stress contexts, this association was significantly smaller among mothers experiencing medium and high CSC levels (Yatziv et al., 2018). Although there is a strong evidence base to suggest that sensitivity is dependent on mentalizing (Zeegers et al., 2017), this relationship does not hold in CSC (Yatziv et al., 2018). It is unclear whether the finding indicates that stressful circumstances impede the translation of mentalizing into sensitive behavior or whether the nature of the underlying mentalizing process (i.e., a movement from reflective to automatic mentalizing in response to stress) drives these findings (Yatziv et al., 2018). Our theoretical inclination would tend to lead us to assume the latter: that it becomes harder to access the reflective (controlled) pole of the automatic–controlled dimension. However, to return to the experience of the infant, and what is communicated to them in these experiences, in a sense is an overly fine distinction. As we have described elsewhere, the communication constituted by "insensitivity" may be that automatic functioning may well be the most appropriate way of operating given the harshness of conditions (Fonagy & Campbell, 2017).

An individual who is operating in a resolutely non-mentalizing environment is likely to struggle to continue to think about their own and others' mental states in a balanced way across the different mentalizing dimensions that we have described above. One of the ways in which this can be applied to thinking about the experience of the parent of a young child is through an awareness that a parent is working in a unique form of non-mentalizing environment – that of a pre-mentalizing baby. A parent without adequate social support from mentalizing others is facing a Herculean social–cognitive task: holding on to the capacity to think about both their own and their child's mental state without the corrective presence of other people's minds to restore a mentalizing balance (Baradon & Campbell, 2022). Of course, as adults, we are protected from the impact of a baby's non-mentalizing state by our knowledge and understanding of a baby's difference in this respect – it is this insight and tolerance that enables us to care for others whose minds are not as ours are. The capacity to hold on to this awareness varies from individual to individual, and nobody's capacity should be assumed to be inexhaustible.

Summary and Key Points

This chapter provided an introduction to mentalizing and how the mentalizing model can inform our understanding of infant mental health and its sequelae. We began by providing an overview of

the mentalizing framework, and in particular the four mentalizing dimensions: self–other, automatic–controlled, internal–external, and cognitive–affective. We delineated how parental mentalizing requires a balance across these four dimensions. We described the developmental trajectory of mentalizing across infancy and childhood, arguing that while the capacity to mentalize is innate, our mentalizing profile is also to some degree shaped by environmental experiences, a view that suggests additional insight into how adversity and trauma affect development and the importance of the mentalizing environment around the child and the need to support parental mentalizing. We described how difficulties in mentalizing – characterized as the three non-mentalizing modes (teleological mode, pretend mode, and psychic equivalence) – might manifest in the context of parenting and how functioning in these modes might impinge on the parent–infant relationship. In addition, we described the particular significance of embodied mentalizing in early development, an emerging and promising area of research in early developmental experiences. We argue that in order for interventions that aim to support the capacity of caregivers to mentalize their infants and young children to be effective, it may be necessary to create a mentalizing social system around the family in which the caregivers experience a collaborative "we-mode" and can invest epistemic trust.

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Mutual Joy and Social Development

24

Tanya Broesch

Half a century of research has made great strides in carefully identifying and documenting "typical" and "healthy" interactions between caregivers and their young infants and linking these features with positive social and cognitive infant development (Ainsworth, 1979; Bowlby, 1988; Lyons-Ruth et al., 1999). However, evidence suggests that the emphasis put on some features of these interactions may be representative of primarily urban and Western populations where most of the research is sampled from and may not constitute an understanding of the majority of the world's diverse social and ecological contexts around the world (Nielsen et al., 2017; Lancy, 2016; Keller, 2013; Greenfield et al., 2003). While these features (e.g., contingent responsiveness, infant-directed speech, and interactive synchrony) may be linked to positive developmental outcomes in some contexts, they may represent behavioral manifestations of a Western interpretation of what is "good" for an infant and not different interactive styles representative of a "good" interaction outside of a "Western" context. By "Western," I loosely refer to industrialized societies who place an emphasis on formalized education. Several scholars have argued that we often see similarities among these societies in which we base 95% of our research on (Nielsen et al., 2017; Broesch et al., 2020; Henrich et al., 2010). Descriptions of traditional indigenous parenting in early childhood suggest that some features look quite different from what we would expect based on personal experiences and research dominated by Western and urban scientists (Muir et al., 2019; Briggs, 1971). As cross-cultural social scientists, Heidi Keller, David Lancy, and others have pointed out, the urban Western context describes only one context in which an infant develops and thrives, and we must look beyond this context to identify elements that cut across cultural boundaries. This is essential from a scientific and also ethical perspective (see Broesch et al., 2020).

In line with descriptions and observations of infants and caregivers across cultures and diverse socio-ecological contexts, it appears that the common element that is linked to a culturally relevant positive outcome for children is the expression of shared positive emotion during social interactions between caregivers and their children—what I refer to as mutual joy. In this chapter, I describe the cross-cultural evidence supporting this statement.

When you observe a typical social interaction between a caregiver and their infant engaged in social interaction, one thing you will notice (that you may have missed) is the sheer joy that both partners exhibit during brief moments of the interaction. During these moments within social interactions, caregivers across the globe

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express delight, (mutual joy), at times, even in the subtlest of ways, in their uninterrupted interactions with their infants. Since I delved into this topic a few years ago, it became apparent that this enjoyment was not restricted to socio-economic context, gender, or culture. Caregivers worldwide express delight in social interactions with infants, and the infants are drawn to these interactions (Chisholm, 1983; Konner, 2005; LeVine et al., 1994; Callaghan, 1984). At the moment, the interaction is the goal in and of itself. What is interesting is that while these shared positive emotions have been observed in early interactions, they are deemed only one component of the interactive system rather than a fundamental aspect of human social development. For example, research has identified the importance of (1) consistent and predictable caregiver responsiveness (Ainsworth, 1979; Bell & Ainsworth, 1972) and (2) synchrony in interaction and emotion (Stern, 2009). While the literature underscores the importance of these elements as they are linked to social, cognitive, and behavioral outcomes, it may miss the foundational and underlying fundamental features that would apply to other non-Western cultural contexts—moments of mutual joy.

Previous work has found infants learn the interactive signature of an adult—whether this is through facial, vocal, or tactile expressions (Bruner, 1982; Fonagy & Targent, 2002; Fonagy et al., 2018). Early work depicting this showed that infants become distressed when caregivers cease their social interactive synchrony during a "still face" episode (Tronick et al., 1978; Mesman et al., 2009). Tronick's work demonstrated (1) infant learning and (2) a preference for an interactive style of their partner (Tronick et al., 1978; Mesman et al., 2009; Bigelow & Power, 2014). Recent cross-cultural work investigating the "still face" using different modalities (facial and tactile responses) across cultures demonstrates that infants are sensitive to learning these social interactive patterns, but that they develop cultural preferences depending on their social environment (Broesch et al., 2022a, b). All of this suggests that while the important literature on infant-caregiver synchrony and interactions may capture significant features of the interactions, it may be describing the social interactive "language" of particular societies that may not represent the majority of the world's population (Broesch et al., 2020; Nielsen et al., 2017). Rather than describing different social nonverbal "languages" or patterns of communication that exist in different societies, it may be productive to identify the underlying structure of the social-communicative interaction rather than the words themselves. In this chapter, I describe evidence showing that the mutual joy that happens between caregivers and their infants and young children is a central feature of typical development that cuts across developmental transitions and cultural boundaries. In fact, I suggest that the experience of mutual joy is critical throughout the lifespan for individual mental health and well-being.

Mutual joy is defined as the experience of shared positive emotions that infants and caregivers achieve together as the goal of social interaction (Broesch & Carpendale, 2022). This is consistent with previous work on dyadic synchrony, shared pleasure, and attunement (Mäntymaa et al., 2015; Stern, 2009; Tronick et al., 1978). Mäntymaa et al. (2015) examined early parent-infant interactive correlates of child well-being and showed that the longer a mother and her infant engaged in shared pleasure (SP) at 2 months of age was associated with the child's social and emotional outcome at 2 years. These mutually joyful experiences begin in infancy and can be seen across cultures as early as the first social smile—around 2 months of age—and continue throughout early development and the lifespan (Lavelli & Fogel, 2005; Stern, 2009). These shared positive moments support and contribute to the development of infant self-understanding, mental state understanding, learning, and communication. Not only are mutually joyful interactions essential for typical development, but they also shape and are shaped by cultural pathways of development (Greenfield et al., 2003). These shared positive moments are the foundation from which the infant comes to develop a sense of agency, identity, and self-worth, and this can be seen throughout the "Western" scientific literature on child development as well as the empirical and ethno-

graphic descriptions of early social interactions in indigenous or small-scale societies (Feldman, 2007; Powers & Trevarthen, 2009; Gratier & Trevarthen, 2008). In the first few weeks after birth, infants show an interest in caregiver attention and emotional rhythm (Gratier & Trevarthen, 2008). Evidence will be provided to show that human development and well-being rests on the early and continued experience of others showing positive emotional expressions during shared social interactions and that this supersedes other behavioral manifestations during interactions that may be culturally variable.

Lachman et al. (2022) investigated parent-infant shared pleasure moments (defined as the duration of synchronous positive emotion) in South Africa, suggesting that shared pleasure duration was not linked to maternal mental health or child health outcomes. The evidence showed a high frequency of positive shared pleasure moments in reciprocal dyadic interactions, suggesting that significant disruptions may only be present in extreme cases. This supports the idea that shared pleasure moments (mutual joy) may cut across contextual and individual differences.

Generalizability

The majority of research in developmental psychology (and the social sciences) has been based on observations and evidence with WEIRD (Henrich et al., 2010) and largely White, middle-class, heteronormative societies (Barrett, 2020; Broesch et al., 2020, 2022a, b). Of course, there have been significant contributions starting in the 1970s by John and Beatrice Whiting, for example, challenging Western notions of child development, yet the work examining non-English societies has constituted only 2% of the research (see Nielsen et al., 2017). I make this point because parenting is influenced by societal factors and goals, such as valuing formalized education and population size and simply examining another society within the USA, for example, does not provide us with an account of the range of variability in human behavior (see Kline et al., 2018). Detailed observations and experimental evidence with a small subset of the world's population have contributed to developing theories of development that may reflect a special niche kind of family instead of capturing the extent of human variation (Kline et al., 2018; Barrett, 2020; Rochat, 2023). There are a series of developmental explanations that have been argued to need revision considering cultural observations of children and families beyond urban majority societies in the West (Nielsen et al., 2017). Cultural anthropologists such as Whiting Beatrice and John Whiting (1975), David Lancy (2016), Barry Hewlett (1993), Melvin Konner (2005), and others have produced detailed observations of child development that appear to challenge current developmental theories. For example, Keller (2013) argued that attachment theory needs revision considering ethnographic and systematic observations of families beyond an urban and Western setting (Keller, 2013). Keller has argued that the three tenets of attachment theory, as proposed by Bowlby, may not be equally valid across diverse social contexts. The assumptions of monotropy, stranger anxiety, and the definition of attachment with the infant embedded into a family context with the mother as the central and most significant "other" in the infant's world may be appropriate for Western middle-class families but may deviate from other models of caregiving (Keller, 2013).

Additionally, we know that language and cultural knowledge are two important and critical features of human sociality—ones that set us apart from other species. However, language development is thought to rest on infant-directed speech when in fact there may be other ways of communicating just as effectively through other modalities (Cristia et al., 2019; Cristia, 2023; Kosie & Lew-Williams, under review). That is to say that the focus on infant-directed speech may be one feature of our culture for engaging with infants and enabling them to learn social communication (Carpendale & Lewis, 2004; Halavani et al., under review).

Additionally, the extent to which we engage in and are sensitive to direct teaching may be a feature of cultures that emphasize and prioritize for-

malized education. David Lancy (2010, 2016) and Michelle Kline (2015) have shown that societies around the globe rely on other forms of learning through imitation and demonstration rather than directed teaching. Lancy (2010, 2016) argues that much of our model of families and child development in our research rests on an assumption of one kind of family that rarely exists outside of a Western context. He argues that the literature on child development reflects this bias and therefore focuses on features that are prominent in Western contexts such as face-to-face interaction, infant-directed speech, and directed teaching. Shared positive emotions is one feature of the early social environment that satisfies both the developmental requirements and anthropological descriptions of caregiving across diverse social contexts (Broesch & Carpendale, 2022).

Mutual Joy and Early Parent-Infant Relationships

Nearly a century of careful and detailed observations of children and families as well as evidence from meticulously designed experimental paradigms has resulted in a consensus that the first relationship between an infant and their caregiver(s) is complex, important, and shapes the developing infant (Bowlby, 1969; Stern, 2009). In the middle of the twentieth century, researchers such as Harlow, Bowlby, and Spitz concluded that primate infants must bond to a *nurturing* mother for healthy mental development. Following Harlow's experiments with non-human primates, demonstrating this preference for "nurturing" caregivers, many researchers investigated precisely what a *nurturing* caregiver should be. The question became precisely which elements of caregiving are necessary for the healthy physical, social, and cognitive development of an infant. In the 1960s, John Bowlby developed a theory of early bonding which emphasized the need for a nurturing secure relationship with a caregiver (Bowlby, 1969). Bowlby found support for his theory of a secure base which suggested that every infant needs one nurturing other to bond to—namely the primary caregiver. In addition, he argued for an evolutionary adaptation that resulted in the infant eliciting nurturance from the mother and the mother eliciting behaviors from the infant that facilitate an emotional bond (Ainsworth, 1979; Bowlby, 1979).

Problems have been identified with Bowlby's work on maternal bonding and Ainsworth's work on attachment—namely, the assumptions of universality in the infant's environment and social setting (Hrdy, 2005; Keller, 2013). Much of the work of Bowlby's was conducted in clinical settings with human mother-infant dyads, and they rest on the assumption of one primary caregiver in a nuclear family household who is responding in particular ways that encourage social bonding to one adult (Bowlby, 1979). Although this theory has expanded to encompass other caregivers, theories based on Bowlby's secure base emphasize and favor the mother as the primary caregiver in the nuclear family model of caregiving (Hrdy, 2005). Over the past few decades, the focus has been on the timely and appropriate responses to infants in the first year of life to support attachment (Waters et al., 2000). The basic tenet of attachment theory is that children must develop a secure dependence on parents before developing the ability to embark in new situations (see Keller, 2013 for a review). Research indicates there is a sensitive period in which children must develop this security (in the first year of life) for healthy social, emotional, and cognitive development (Bell & Ainsworth, 1972; Bowlby, 1988). There is agreement among scientists that early social interactions between a caregiver and an infant in the first year of life are critical to forming this healthy bond with a caregiver (Bruner, 1982; Ames & Chisholm, 2001). We also know that there is significant variation across cultures in the social context in which an infant is born (Kartner et al., 2010; Lavelli & Fogel, 2005; Hewlett, 1993; Konner, 2005). Given that there is such variation both within and between cultures and families in what constitutes a healthy caregiver-infant relationship, what features are providing the foundation for healthy social development? Although previous work

conducted in the West has found that secure attachment is associated with caregiver contingent responsiveness to infants, this perspective must be expanded, considering evidence that responsiveness is diverse across cultural contexts, to understand what begets secure attachment (Keller, 2013).

Cross-cultural investigations of caregivers and their infants by Heidi Keller and her colleagues have found that Nso caregivers in Cameroon respond significantly differently compared to German mothers—with Nso emphasizing different ways of responding, such as tactile and physical closeness, compared to German mothers who relied on visual and vocal cues when responding to an infant (Keller et al., 1988). Similarly, other work examining the onset of the social smile across cultures has found that infants begin smiling around the same age, but the ways in which caregivers respond to the smile differ (Wörmann et al., 2012). Work by Broesch et al. (2016) found similarities in caregiver responsiveness to infants (frequency) but differences in the ways in which caregivers responded. They found cross-cultural differences in the selective response to infant affective displays with mothers from some societies being more likely to respond to a negative emotional display compared to a positive one. The authors also found that more mothers in the USA were mirroring their infants' affect compared to mothers in Fiji and Kenya (Broesch et al., 2016). Keller et al. (2009) interpret cultural differences by referring to parenting behaviors, practices, and goals that emphasize physical closeness as "proximal" parenting and those that emphasize infant-directed speech and face-to-face interactions as "distal" parenting styles (Keller et al., 2009). The authors argue that attachment theory and research supporting it are based primarily on evidence with families in societies emphasizing "distal" parenting styles. In fact, research by Chisholm with the Navajo was some of the first to question the basic tenets of attachment theory in light of his long-term observations of Navajo families (Chisholm, 1983).

In 1971, Munroe and Munroe conducted a reanalysis of Ainsworth's data investigating attachment in Uganda. They found that mother-infant attachment was inversely related to the number of individuals in a household. The more people in the house, the less attached an infant was to his mother (Munroe & Munroe, 1971). What this demonstrates is that variability exists and that this variability may be leading the infant down a culturally appropriate developmental path (e.g., one of multiple diffused attachments). It is important to consider that such differences may appear to reflect only variation in parenting styles and social contexts, but they are not typically interpreted in that way. Others before me have made this claim, yet the *primary* focus of the literature has been on identifying features of the interaction that are common across diverse contexts (Crandell et al., 1997). However, the literature indicates that such variations may in fact have functional significance in the life of the infant and therefore deserve more than simply descriptive attention.

Additionally, recent research on infant-directed speech now suggests that much of the speech that infants hear in the first year of life in less well-studied societies is, in fact, overheard speech (Cristia et al., 2019; Cristia, 2023). Yet, our understanding of infant language development is based on research with infants in urban and Western environments who engage in distal parenting styles with an exaggerated manner and amount of speech to infants compared to most other societies, and our theories of language development have rested on the idea of infants as recipients of substantial amounts of infant-directed speech. All of this suggests that although developmental science has reported some interesting common caregiving behaviors that have been linked to positive social and cognitive development in children, these findings are based on a small sample of the world's population and cross-cultural literature challenges these findings. Great strides are being made to broaden our understanding of families beyond an urban, industrialized, and Western setting over the past decade, but the primary sample base continues to have a Western bias (Nielsen et al., 2017).

Furthermore, these shared positive experiences are common across developmental theories

and empirical evidence. Bowlby (1969) states that infants form attachments with those whom they engage with in social interactions. The first year of life is essential for the formation of secure attachment in infants (Bowlby, 1979). Yet, we know that the ways in which this happens can be different across cultures (Keller, 2013). Since attachment theory, there have been 70 years of research microanalyzing the early relationship to identify which features of the early caregiving relationship are essential to forming this bond. At the same time, there has been research examining what happens when there is an absence of a strong social bond (Ames & Chisholm, 2001). All of this together suggests that there is *something* to this first relationship that is essential for healthy human development. What is it and how does it support development? Research has focused on the things that caregivers do with their young infants such as examining how and when caregivers respond to infants. However, we know from the enormous variability that has been documented that what is timely and appropriate is vague and imprecise and can vary significantly by group (Greenfield et al., 2003; Broesch et al., 2016). I, like others before me, suggest that we focus on the relationship as a whole and not solely the behavioral components of a relationship (timing of responsiveness and shared emotional moments), which may miss out on the richness of the affective bond between an infant and her caregiver.

Additionally, some evidence suggests that this interactive positive emotional engagement or mutual joy is linked to secure attachment (Anhert, 2021; Thompson & Meyer, 2007; Raymond et al., in preparation; Broesch et al., 2023). In a recent investigation of fathers and their young infants in Vanuatu (Tanna) and Bolivia (Tsimane), researchers found that the degree to which fathers were reported to play with their children was the single most predictor in secure attachment between fathers and children compared to several other demographic, individual, and observational measures (Raymond et al., in preparation).

Stern summarized the affective dance between an infant and her caregiver and explored the concept of affective attunement among middle-class US families (Stern, 2014). Several definitions of "attunement" exist in the developmental literature. Stern described attunement as the interactional dance between an infant and her caregiver (Stern, 1985, 2014). He describes this "dance" as a nonverbal communicative system in which the goal is to achieve interactional synchrony while keeping the infant in an optimal aroused state. This "dance" between a mother and her infant is described in great detail, with the mother altering her behavior as needed to sustain the infant in this aroused state. The infant, too, engages actively in this communicative flow of facial, vocal, and tactile responses. I have selected Stern's definition of attunement in its most elemental form to extract quantifiable behaviors in studies that were not looking for such interactional synchrony. Stern defines attunement as the caregiver matching the infant's affective state (Stern, 1985). He claims that caregiver social behaviors that are elicited by the infant are typically exaggerated and stereotypic. He and others state that infant speech, baby faces, and gaze behaviors are exaggerated in the following ways—speech with raised pitch, exaggerated contours, and reduced rate; facial expressions exaggerated in the fullness of display and for longer duration; and gaze behaviors exaggerated in duration (Stern, 1985). He also claims that these proximate "*en face*" interactions are best suited for the infant to focus on and attend exclusively to the adult's behavior. He indicates that the caregiver must assess the infant's arousal level and mirror that level back to him. However, the mirror must not be exact—it must be an imitated "level of arousal" or "vitality affect" which means that it can exist in another modality—either facial, vocal, gestures, or body movements. In essence, Stern claims that for the caregiver to succeed in maintaining the infant's attention and arousal level, the caregiver must attempt to keep the infant within a specific range of arousal. This range can be maintained by the parent mirroring the infant's affect level imperfectly—either by selecting a different modality (gestures, vocal, facial expression, and tactile) or by imitating with exaggeration (therefore not mirroring exactly—he claims that true imitation renders form, yet attunement renders feeling).

Many others are in agreement with Stern's view that maternal affect matching plays an important role in the first 9 months of life (Field, 1977; Trevarthen, 1979; Malatesta & Haviland, 1982).

Stern breaks down his definition of attunement into three distinct parts—intensity, timing, and shape. This means that an imitative maternal smile can be broken down in the following ways: the level of intensity (positively aroused), the temporal beat (within a second), and the shape or kind (smile). Typically, these behaviors are coded during episodes of a matched, synchronous state. However, such microanalysis is typically not conducted for "attunement" in developmental field observations. Therefore, in order to capture some essence of the behavior in the cross-cultural literature, the following behaviors may serve as evidence for attunement: (1) *any kind of same or cross-modal imitation or matching of an affective state* and (2) *mutual gaze*. Although neither one of these alone is sufficient evidence for Stern's elaborate definition of attunement (and some may argue that the sum of these behaviors remains insufficient as well), this is my operational definition of attunement to assess the presence or absence of this behavior across a wide variety of methodologies hoping to gain insight into the validity of such theories.

I have included instances of "mutual gaze" as recorded by microanalysis as evidence of attunement, broadly defined. Although the case of eye contact is a discussion worthy of its own paper (see Dixon et al., 1984), it may be an indicator of a matched state. Although the absence of this behavior does not mean that states are not matched, the presence of it has been accepted as a matching of states (see Stern, 1985 for a discussion of mutual gazing as an indicator of attunement). As defined by Stern, attunement refers to "interactional synchrony"; therefore, mutual gazing may be one way of communicating a synchronous state or awareness. Although in the counterexample, one individual may experience positive affect while the other negative, both may be engaged in a mutual gaze; however, it does indicate a synchronized attention level—I am attending to you and you are attending to me.

Additionally, this theory is laden with assumptions regarding the "optimal" level of arousal, as well as parental goals, desires, and opportunities for active engagement. Importantly, it must be noted that attunement is distinguished from affective mirroring in the following way—rather than mirroring the infant's exact affective display, the mother may display attunement through another modality. For example, an infant may express fussiness and discontent through crying (vocal affective display) while the mother matches this state through her rapid tactile response or negative facial expression. *Attunement* is not restricted to one modality and is often expressed across modalities. Evidence for attunement has been captured by synchrony in the mother-infant dyad emotional state as indicated by a matched level of arousal. It is distinguished from affect mirroring in three ways: (1) The discrete emotional state need not be mirrored; rather, the general affect must be matched; (2) it can exist across modalities; and (3) it need not be (but may be) exaggerated, merely matched.

Affective attunement has also found support in contexts as diverse as Atlanta, rural Kenya, and Fiji (Broesch et al., 2016). Affective attunement may play an important role by modeling emotions for infants and thereby shaping an infant's developing understanding of emotions and social communication. Although some evidence suggests that caregivers may engage in this affective dance with infants cross-culturally, I argue even attunement can be further reduced to a basic experience of shared mutual joy that is cross-culturally applicable and not restricted to specific populations.

In Chisholm's (1983) report on the Navajo infancy and the use of the cradleboard, he describes a caregiving style in which there is little time for face-to-face interaction, let alone synchronized behavior and contingent responding. To summarize, infants in this environment spend a significant amount of their time bound tightly to a board separate from their mother in the first year of life, although always within a few meters of each other (Chisholm, 1983). Infants are expected to stay on the cradleboard for much of the day, and there is little fretting by the infant

and little contact with the mother during this time. Mothers tend not to respond to fretting and "closed mouth" cries, and infants are found alone on their cradleboard with no one interacting with them for much of their waking time. Chisholm recorded behaviors by both the mother and infant during systematic and repeated visits to households. In his observations, he found that mothers respond in a manner that is like that of Western mothers, primarily during times of *transition* when the infant is put on or removed from the cradleboard. During these few times throughout the day, Chisholm reports that mutual gazing reaches a peak when the infant is put on the cradleboard (evidence for attunement) and he also reports that the mother and infant appear to be in synchrony during this time, although he does not define what he means by "synchrony" (Chisholm, 1983). As Chisholm writes, the infant's rate of smiling decreases as he goes on the cradleboard and so too does the mother's rate of smiling. In addition, as the infant's rate of smiling increases so does the mother's. Lastly, as the infant's rate of non-fret vocalization decreases as he is put on the cradleboard, so does the mother's rate of verbalization and vocalization. These findings suggest that one must go beyond ethnographic reporting and conduct a systematic microanalysis of these behaviors to determine whether they exist. In an environment where the infant spends much of his waking life not being spoken to or held by an adult, one would expect to find very little of these behaviors at the macrolevel or at first glance.

Mutual Joy and Sense of Self

The first social relationship humans experience is that between an infant and her caregiver (Stern, 2009). Infants are born premature, helpless, and dependent on the care, protection, and love of those around them. How caregivers respond to their infants depends on their parental well-being (Fonagy et al., 2018), their support (Özker et al., in preparation), their cultural goals (Greenfield et al., 2003), and their historical, social, and economic context. We know that humans are variable in their ways of life—more so than any other species as we have expanded and populated nearly every corner of the globe. Therefore, caregiving reflects this variability—we see significant variability in early caregiving behaviors—parenting socialization goals and, as a result, the timing and sequence of some developmental milestones (Adolph & Hoch, 2019). Caregivers respond to infants with significant variability starting as early as the first months of life (Broesch et al., 2022a, b; Wörmann et al., 2012). Some research has reported that cultures exist in which face-to-face interactions are not only discouraged but also viewed as harmful to infants (Dixon et al., 1984). Cross-cultural work by Wörmann and colleagues found that parents respond differently to infant smiles when the infant is around 2 months of age—with some cultures encouraging the social smile and other cultures discouraging by not responding or averting gaze (Wörmann et al., 2012). Additionally, Broesch et al. (2016) found that parents respond differently to the kinds of emotions that infants express. These are examples from developmental literature indicating that parental responsiveness and early socialization are different depending on the culture in which one is born. However, the common element of these early social interactions appears to be mutual joy and those experiences serve as the foundation for a developing sense of agency. In line with previous literature on caregiver-infant interaction (reviewed above), I suspect both within- and between-culture variability with respect to the amount of and ways in which mutual joy is expressed.

Keller et al. (2005) suggest that a more distal parenting style fosters more independent children as indicated by passing of the mirror self-recognition task (Keller et al., 2005). They captured "distal parenting style" by measuring contingent maternal responsiveness with the higher probability of contingent responding being "proximal" and lower scores being "distal." Whether this distinction is valid, they did find that the German parents responded more contingently to their infants at 3 months of age compared to the Cameroonian mothers (Keller et al., 2005). Contingent responsiveness was positively correlated with passing of the mirror

self-recognition task with more Cameroonian children passing at a later age. The idea is that the distal parenting style fosters autonomy, whereas the more proximal style of parenting fosters less autonomy—as indicated by behavior in front of a mirror. If so, such results may suggest that contingent, reliable responding is a necessary feature for forming healthy mother-infant bonds among other things, yet the level of contingency results in early socialization—something parents (and researchers) feel is intuitive yet may be culturally determined.

Another study suggesting variability in these behaviors was reported in 1984 by Callaghan. He compared three distinct cultures in the USA—Anglo, Hopi, and Navajo mothers engaged in face-to-face interactions with their infants in their homes (Callaghan, 1984). He found that Anglo mothers engaged in more vocalizations and total behaviors than the other two groups (Callaghan, 1984). Interestingly, he noted that all groups had comparable amounts of mutual gazing (attunement); however, Hopi and Navajo, but not Anglo mothers, had a tendency to engage in vocalizations during episodes of mutual gazing (Callaghan, 1984).

In addition, Hopi mothers scored higher than Anglo and Navajo on tactile behaviors. Such observations indicate interesting variability which may not be captured through sampling of homogeneous groups. For instance, one may speculate about how mothers in different cultures *use* different modalities for responding to their infants. It is possible that a culture such as the Hopi may present evidence of all three behaviors (attunement, affective mirroring, and contingency) through tactile responses. If we limit our laboratory observations to more dominant Western or industrial societies, we may in fact be missing rich data hindering us from the necessary progress and theoretical revisions needed to fully understand early social and cognitive development. Maternal responsiveness through facial and vocal actions is merely one way to be attuned to and respond to an infant. Take the example of the un-diapered infant—whose mother "just knows" when he is about to go to the bathroom (Small, 1999, p. 169). Could this be attunement in another cultural context? One that might satisfy the infant's needs for maternal responsiveness without the cooing and baby talk that we see of parents in the West?

In the Gusii population of East Africa, LeVine et al. (1994) systematically videotaped mothers interacting with their infants in an isolated dyadic context. They analyzed the behaviors of both partners using frame-by-frame analysis, and they reported gaze aversion by the mothers during peak affective displays by the infant (LeVine et al., 1994). In addition, the authors report a general lack of interest by the caregivers in maintaining any peak in attention or state by the infants. The authors compared these observations to an American sample in the same context and found that mothers exaggerated and imitated peak affective displays of emotion (LeVine et al., 1994). They report that American mothers appear to satisfy an implicit goal of building upon, amplifying, or extending the affective state, whereas the Gusii have the goal of dampening, diffusing, or diminishing the affective level (LeVine et al., 1994).

Through these early interactions, infants develop an understanding that they themselves influence the world—they can elicit and share in the positive experiences of another. These social interactions begin shortly after the first month of life and continue throughout adulthood. They begin with the social smile—when the infant begins to show delight in the mere presence of another social interactive partner (Rochat, 2004). It is essential that the infant develops an understanding not only that others are "like me" but that others take delight in their presence—and they begin to recognize this reciprocal relationship. A child's self-worth is then built on this ability to see others take delight in them and to influence the experience of others through this early social connection. These interactions go beyond intersubjectivity, contingency (Bigelow & Power, 2014), and attunement (Stern, 2009) and emphasize the foundational nature of the shared positive emotions—mutual joy. Contingency appears to impact the rate at which infants expect a response—in other words, infants develop a social "signature" of their caregiver

and they begin to expect that level of responsiveness from other interactive partners. While the rate of responsiveness is clearly an important feature of the relationship as infants need a predictable and stable environment, it misses out on the importance of joyful moments—which, I argue, are at the crux of forming these long-lasting bonds. Although one study found similar rates of contingency (Broesch et al., 2016), several other studies suggest that responsiveness is culturally variable (see Keller, 2013).

Mental State Understanding

To relate to or empathize with another individual human requires some recognition that the individual has emotions and cognitions like oneself. One must "get into the shoes of the other" to develop an understanding of the different beliefs, emotions, thoughts, and perspectives that others have. This is simply not a cognitive appraisal of context, but rather an emotionally laden task requiring infants to identify with others and feel, see, hear, and think in ways like the other. This means a self-understanding that moves beyond the self and encompasses others through intersubjectivity (Rochat, 2004; Broesch & Robbins, 2023). This becomes possible not only with varying examples to compute and deduce, but rather with the experience of feeling what someone else is feeling at the same moment. To expand the self, I argue, we must first have the experience of joyful positive moments synchronized in space and time, with another human being. This expanded sense of self can be seen with cross-cultural research examining mirror self-recognition. In research that has examined mirror self-recognition across several cultures including the urban US population, they found that American children were an outlier in the extent to which they self-refer when faced with their mirror image (Broesch et al., 2011). Less represented societies in the literature, such as Vanuatu, demonstrate either a delayed self-recognition (Cebioglu & Broesch, 2021; Cebioglu et al., 2022) or a lack of motivation to self-refer and modify their image (Broesch et al., 2011; Rochat et al., 2012). I interpret this to suggest that there is an expanded sense of self in cultures that are less focused on the individual, yet the point here is that self-understanding is developed through shared positive moments—a way for infants to learn about the self as it relates to others.

Learning

Over the past 20 years, there has been an increased interest in one facet of human uniqueness and that is how humans acquire cultural knowledge, that is, any information or skill that is passed down and across generations through social learning. Although there are a variety of ways in which one can learn culturally relevant skills and knowledge, there is a consensus in the literature that humans are unique in the extent to which we learn from one another (Boyd et al., 2011). Not only is this theoretically interesting as humans are the only species to engage in such widespread and complex levels of cultural transmission, but it is also important from a developmental perspective—how do our ideas spread? How do infants and young children learn the information of their culture that is required to survive? The idea is that there is something unique to human learning that enables us to focus and attend to culturally relevant knowledge (see Gergely & Csibra, 2020). There are several theories seeking to explain the complexity of human cultural learning—that is, learning information and skills from others. One common element among them is that early in development, infants are ready to attend to and learn from others—they are born ready to engage in social interactions. This is first seen with the onset of the social smile, and shortly thereafter, infants around 4 months of age show that they have already learned and developed expectations regarding social interactions. Under the umbrella of the human cultural learning literature, scientists have focused on the question regarding *how infants and young children learn*

the relevant information of their culture with high fidelity. The question is how do they learn to focus and attend to relevant information? One cannot survive on the planet without learning from others, and the human extent of social learning is unmatched. Therefore, what is unique about human social learning? Here, I add to the theoretical perspectives before me in that I argue that mutual joy is required to focus the attention of the infant on the relevant features of a learning moment. Although this adds a minor element to this complex ability, it is a critical point. This is in line with Csibra and Gergely's theory of natural pedagogy (2009) where they claim that infants must be drawn to the relevant features of an event for them to have efficient cultural transmission. In their theory of learning, the infant is drawn in by a caregiver calling the infant's name or addressing the infant in a high-pitched tone using infant-directed speech—yet we know that infant-directed speech is quite variable across societies. Mutual joy, however, may provide the foundation—the classroom for infants to learn from social others.

Summary and Key Points

Mutual joy is a feature of early social interactions across diverse contexts, and it is, most likely, not simply a feature of urban, Western, and formally educated societies. Although I propose that these early positive experiences are both essential contributors to development, the mechanism by which this happens remains unclear and in need of examination. A recent summary of the research examining well-being across the cognitive and affective neuroscience literature as well as clinical psychology suggests that there are four core dimensions to well-being—awareness, connection, insight, and purpose (Dahl et al., 2020). In this chapter, I suggest that the experience of mutual joy in infants is particularly important for forming strong social bonds, for learning about the self and others, and for developing a secure base from which to explore the world. Future work will examine literature beyond infant and early childhood to examine the impact of these mutually joyful experiences across the lifespan.

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25

Population Health Opportunities in Pediatrics to Support Infant and Early Childhood Mental Health Promotion and Prevention: The HealthySteps Model

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The field of Infant and Early Childhood Mental Health (IECMH) is too important to be relegated to one corner of our service system and needs to expand to leverage more pathways for supporting babies, toddlers, young children, and their caregivers. Referring to specialty practitioners to provide care for children and family dyads is a vital part of child well-being, but this specialty care model has limitations and lacks the large scope of a population health approach. With a bigger arena, we can move toward improved societal impact.

Primary care holds great promise in this larger arena. When pediatric primary care[1] practices promote social–emotional well-being by providing screening, preventive education, and care coordination around referrals, they are mitigating compounded issues as well as the potential need for more intensive and costly interventions later in life.

Bringing an IECMH approach to pediatrics also helps providers maintain a connection with families and reduces the need for external referrals to specialists. The HealthySteps (HS) model, with the integration of behavioral and social–emotional health via a HealthySteps Specialist (HS Specialist) placed in the pediatric setting, maximizes the integration of IECMH within practices and across disciplines. HS includes a full practice approach, aiming to provide care in an equitable manner across all levels of the socioeconomic strata and among all racial, ethnic, linguistic, religious, and cultural differences. While pediatric care looks different around the world, with various individuals serving as primary healthcare providers for children, the promise of the platform remains universal. Beyond HS and related programs in the United States, there are emerging examples across the globe. In Singapore, pediatric doctors and nurses provide screening at regular times throughout a child's first 4–6 years (Choo et al., 2019; Kim, 2022) while in Norway, developmental monitoring is

[1] Includes Family Medicine Practices.

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conducted as part of a child's regular visit and is based on clinical judgment and parental concerns (Kim, 2022).

Systemic racism and wealth disparity—along with longstanding and persistent discrimination and marginalization—are undeniable factors contributing to health discrepancies and provide a convincing argument for population-based, preventive physical, behavioral, and mental healthcare for babies, toddlers, and their families (MacLaughlin et al., 2021; McGhee, 2021). The COVID-19 pandemic further exacerbated these disparities and structural barriers, which often have harmful, life-trajectory altering effects that start before birth and too often result in decreased health and well-being, premature illness, and death (MacLaughlin et al., 2021; Patrick et al., 2020). In the United States, babies and toddlers from all races and ethnicities, aside from Asian and white, face food insecurity at elevated rates (Keating et al., 2022). Additionally, instances of both preterm birth and low birth weight are notably higher in newborns from Black US families—a significant risk factor in ongoing health (Keating et al., 2022). Across multiple measures and many years, families with low income and families of color face multiple and pervasive barriers to good health (Keating et al., 2022).

The pediatric primary care setting is a relatively nonstigmatized space to reach all families (Klass et al., 2021), with ongoing, frequent connections between primary care providers and families. In the United States, pediatrics reaches young children near-universally with approximately fifteen well-child visits before kindergarten, seven of which are front-loaded in the first year (AAP, 2022c), providing families the opportunity to acknowledge and address challenges as early as possible. The US well-child visit schedule allows for anticipatory guidance and surveillance (AAP, 2022b) of child development and risk factors within an ideal venue for reaching almost all young children and their caregivers. Looking internationally, Norway reaches nearly 100% of children aged 0–5 for preventive care and developmental check-ups, and all medical care and mental health care and dental care are free for children from birth to age 18 (Kim, 2022; Valla et al., 2015). In Finland, annual well-child visits are offered free of charge, as is all prenatal and perinatal care (Kim, 2022; National Center on Education and the Economy [NCEE], n.d.). In Estonia, primary care is free and includes addressing developmental concerns and school readiness (Kim, 2022). When paired with principles of IECMH and universal screening and follow-up, this nonstigmatized universal approach creates a standard of pediatric care that promotes the interruption of intergenerational transmission of trauma and brings team-based, trauma-informed solutions to families most at risk.

A two-generation lens is also vital to providing comprehensive care for babies, young children, and their families. Babies do not go to the doctor's office by themselves. Donald Winnicott once noted, "There is no such thing as a baby, there is a baby and someone," about which he explained, "I once said: 'there is no such thing as an infant' meaning, of course, that wherever one finds an infant one finds maternal care, and without maternal care there would be no infant." (Winnicott, 1965/2018, p. 39). While his statement about maternal care is certainly outdated as there may be multiple primary attachment figures—of various genders—that serve as this "someone," the primacy of a baby-caregiver dyad remains. Bringing IECMH into primary care pediatrics, as HS does, aims to ensure that this unit is the focus of care in pediatrics—whether the dyad is a baby with a mother, father (or both), or a grandparent—underscoring the promise of this setting for IECMH promotion and prevention.

What Is the Dilemma and How Can HealthySteps Help?

Understanding the Dilemma

In the United States, IECMH and pediatrics are often isolated from one another except for the occasional connection through referrals. Within a traditional care model, pediatricians and other primary care providers need to notice when families require more support and coordinate success-

ful referrals to the specialty care system. This may be an unrealistic expectation, especially given the constraints of a pediatric well-child visit in the United States, which has decreased in time duration yet increased in the amount of information to provide, making thorough anticipatory guidance rare (Buka et al., 2022; Halfon et al., 2011). Without this guidance, families are often not receiving the education and counseling required to improve the social–emotional development of their young children.

Another barrier is difficulties in implementing universal screening. In the United States, the national average for developmental screening in pediatrics, including language, behavior, and social development concerns, is only 37% for children ages 9 to 35 months (Data Resource Center, 2020). If providers are unable to screen efficiently and coordinate needed follow-up, they may not be able to detect the pink flags—the less apparent issues that present themselves *before* the red flags of obvious problems—which leads to missed opportunities for IECMH prevention and promotion.

Unfortunately, the US pediatric health system often "adopts a 'wait and see' approach" (Buka et al., 2022, p. S2) in which identification and intervention only occur after significant symptoms emerge. The Early Intervention (EI) system, to which many children are referred, only finds children eligible for services when they have missed a significant milestone (or more than one) and are diagnosed with a disability or a delay in development.

Even if pediatric providers identify psychosocial issues early and are aware of a system in their community that focuses on prevention, they are faced with the additional barriers of not having the time to refer nor the ability to follow up on referrals. The American Academy of Pediatrics (AAP) has provided guidance through competencies and algorithms to aid in integrating mental health into primary care workflows, but they acknowledge the challenges busy medical practices face (Foy et al., 2019). Depending on how the provider communicates and engages with the family, the family may not disclose these types of concerns (Gleason, 2018; Wissow et al., 2005).

Even when pediatric primary care providers are able to identify psychosocial issues early, are aware of a prevention-focused system in their community, and successfully coordinate a referral, the ability to locate and find practitioners can be challenging due to a shortage of trained workforce who work with very young children (Gleason, 2018). Even as the IECMH field has grown, services are often limited with long waitlists (Giordano et al., 2021), and their cost often discourages families from continuing (Reardon et al., 2017).

There are several clear opportunities for the IECMH field to integrate within pediatrics to ensure efficient and comprehensive care is provided. Creating a bridge to IECMH in the pediatric setting has the potential for a significant impact on the US and global pediatric care system. As noted, a handful of countries around the world do integrate many components of IECMH into pediatrics and provide comprehensive and free services to their populations, and while we will present the US-based HS model below as a bridge between IECMH and pediatrics, we acknowledge multiple solutions may exist.

HealthySteps as a Bridge

HealthySteps is a program of ZERO TO THREE and a risk-stratified, population health-based model that allows pediatric practices to streamline and enhance their implementation of the AAP's Bright Futures guidelines (AAP, 2022a). HS also serves as an efficient linkage with more intensive IECMH services, bringing support to babies, children, and caregivers with a particular focus on families with the highest needs and families with low incomes. A strong emphasis on building healthy relationships—between caregivers and children, between families and healthcare providers, and among healthcare professionals—is a guiding principle.

The tiered model of HS, described below, facilitates health equity by directing resources where they are needed the most—to those who cannot get them elsewhere. As noted by Margolis et al. (2022, p. 268), "…HS uniquely expands the

PPC (pediatric primary care) capacity to promote equity and reduce disparities early in life due to its family-centered, relationship-based, and preventative approach."

Tiers of Service and Core Components

The HS model is organized to include three Tiers and eight Core Components designed to provide universal screening, positive parenting guidance, care coordination, early learning resources, and targeted support responsive to each family's needs, with increasing support as risk rises (Valado et al., 2019). The entire pediatric practice is trained to work together to implement the model (Fig. 25.1).

Universal services (*see* Tier 1) are delivered to all young children and families in practice to ensure equitable and early identification of children at risk for suboptimal developmental outcomes. These services include child developmental, social–emotional/behavioral, maternal depression, and family needs screenings; and needed follow-up. All families with young children also have access to a family support line. Based on these universal screenings as well as clinical judgment and/or family concerns, the practice identifies the subset of children and families (typically up to 30% of a practice's total) in need of additional services from Tiers 2 and 3.

Families with moderate concerns (typically up to 15% of a practice's total) additionally receive short-term support services (*see* Tier 2) to address issues such as child behavior, sleep, feeding and nutrition, attachment, maternal depression, and social determinants of health such as housing insecurity and economic instability. Services take the form of development and behavior consultations with the HS Specialist; positive (rather than punitive) parenting guidance; sharing of resources to support early learning; and care coordination/systems navigation services to successfully connect families to community resources.

While HS is a full practice model, with Tier 1 offered to all, children and families with the greatest needs (typically up to 15% of a practice's

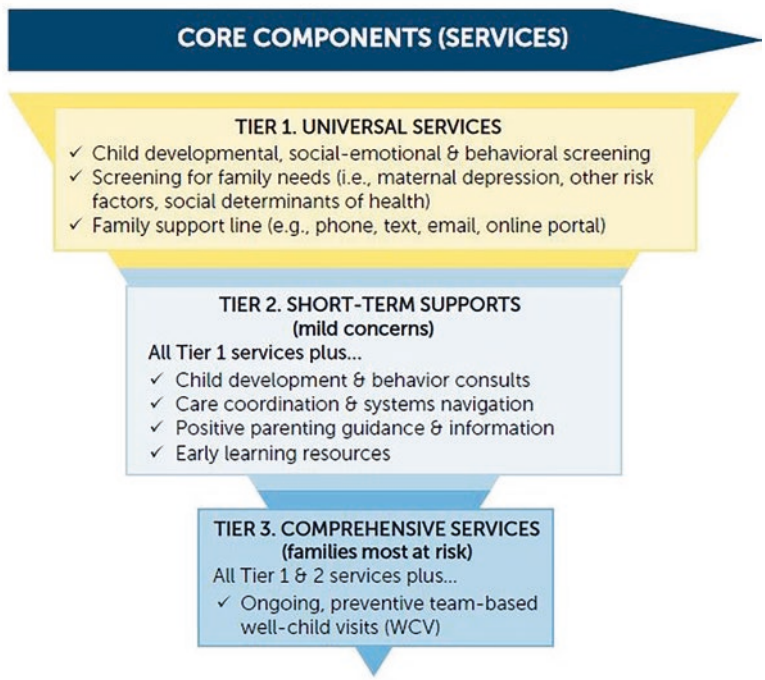

Fig. 25.1 HS core components

total) receive comprehensive services (*see* Tier 3) in the form of ongoing, preventive, team-based well-child visits during which both the HS Specialist and primary care provider meet with families. The HS Specialist establishes a trusting relationship with each family and provides tailored information and support during well-child visits. Criteria for enrollment in Tier 3 services are determined by each practice, though common enrollment criteria factors are parental and/or provider concern and screening results. For families that need additional intervention beyond the scope of the team, the HS Specialist provides referrals and follows up during or between well-child visits to ensure success. This risk-stratified and population health approach allows practices with a single HS Specialist to serve up to 2000 children and their caregivers annually (Valado et al., 2019).

An HS Specialist's role is unique within the US healthcare system in the way they connect and liaise with primary care providers, children, and their caregivers. With short windows for standard visits, fully meeting the needs of families can be challenging, and HS Specialists ease and expedite coordinated care. While most HS Specialists are clinicians (e.g., social workers, psychologists), the competencies (further detailed below) for the role of the HS Specialist promote consistent quality care even when there are differences in their backgrounds, licensing, or certifications.

In addition to the standard Competencies, eLearning courses are available for HS Specialists who do not have a deep background in early childhood development. In fact, instruction on a variety of topics is provided to as many staff as possible at HS sites during the onboarding process, promoting a trauma-informed lens and a high standard of care for families throughout the practice. No matter the background of HS Specialists, the HS National Office provides initial and ongoing professional development to scaffold their work. HS Specialists then become an additional set of uniquely "trained eyes" to flag concerns and provide surveillance and support within primary care—expanding the IECMH lens to their medical colleagues.

Where Does HealthySteps Fit on the Continuum of the IECMH Field?

IECMH includes a continuum of promotion, prevention, and intervention. HS sits primarily on one end of this continuum, providing tiered services that support behavioral health promotion and prevention. Approximately 75% of HS Specialists have a mental health background (ZERO TO THREE, 2020), and all employ principles of behavioral health prevention and promotion in their work. By proactively addressing psychosocial issues, HS Specialists are actively supporting families from the first days of a new baby's life to promote secure attachment and reduce toxic stress for both the infant and the caregiver. By holding both infant and caregiver(s) in mind, employing motivational interviewing, principles of reflection, relationship building, cultural humility, and curiosity to inform their work with families, HS changes how pediatric primary care views and treats the patient: not as an individual but as a family unit. While HS Specialists are not typically providing interventions like Child–Parent Psychotherapy (CPP, 2022) and others on the intervention side of the continuum, they are on the front lines of prevention, noticing early attachment concerns and other pink flags, and are specially trained to see, support, and refer when concerns are outside their scope.

How Does HealthySteps Both Support Families and Transform Primary Care Pediatrics?

Most caregivers respect and trust their pediatric providers, and HS Specialists benefit from this trusted relationship. ZERO TO THREE's National Parenting Survey in 2018 found that 83% of US caregivers frequently trusted their pediatricians for advice and 93% showed a high degree of trust in the information shared by these professionals, illustrating that well-child visits are not just about health; caregivers see them as opportunities to get their questions about child-

rearing answered too (ZERO TO THREE, 2018). Yet, this can be a mismatch when medical providers are overwhelmed with high caseloads, screening recommendations, scarce resources and are pressured for time. Pediatric care providers are trained to focus on physical health—which is largely what insurers pay for—making it even more challenging to integrate additional services (Valado et al., 2019). Even when providers want to give attention to child behavior, parent–child relationships (attachment), and family circumstances (SDOH), it is often not feasible without billing codes and/or alternative payment models to support the integrated workforce. Given these factors, the HS Specialist becomes an important care professional to meet the needs of both families and providers.

However, not all families are eager for consultation. The ongoing systemic and individual trauma experienced by families when seeking medical care, as well as the role of the historical impact of generational trauma, may leave caregivers guarded, wary of any outside judgment of their circumstances, and/or ability to care for their young (Schleifer et al., 2019). Families struggling with adversity, trauma histories, and poor social determinants of health may be quite hesitant to trust an additional consultant at the doctor's office out of fear they will be judged or perceived as unable to meet their baby's needs, and may need more time to build trusting relationships with their children's medical team (Schleifer et al., 2019). The HS model promotes relationship building as the periodicity of well-child visits allows cautious caregivers to wait and see if their HS Specialist is indeed trustworthy. Trust grows over time when caregivers observe practice staff treating the HS Specialist as an esteemed colleague with warmth and respect. Additionally, the HS Specialist builds trust by listening to caregivers carefully, asking open-ended questions free of judgment, and noting where caregivers already feel confident by asking if they want information before offering it.

Many Tier 3 families meet their HS Specialist at the newborn visit, an early weight check, or at the 1- or 2-month well-child visit. This allows time to begin building a trusting relationship, offer anticipatory guidance, and provide interventions as needed. Those interventions occur on a spectrum, ranging from a lighter touch (e.g., one-time anticipatory guidance) to more considerable support (e.g., consultations, referrals for psychotherapy), but all are provided early when the benefits are most effective and allow for the greatest impact.

Case Example: A mother angrily complains during her baby's four-month visit that her daughter is greedy. The HS Specialist inquires what makes her know this. Mom replies that baby drinks more formula than she is "supposed to" as it is more than WIC (Women, Infants and Children supplemental food program) provides, and she cannot afford more. The HS Specialist empathizes about how stressful it must be to fear that she will not have enough to feed her baby. The HS Specialist, noting the mom's initial negative attributions toward her baby, listens attentively and reflectively with a trauma-informed lens, looking for opportunities to continue supporting the dyadic relationship. They explore mom's financial pressures, family support, typical feeding behaviors (including recommendations on when to introduce solid foods,) signs of satiety, and baby's growth chart.

These types of extended conversations can have a positive impact on the emerging attachment relationship between caregiver and baby and are unlikely to occur in a typical, busy well-child visit. When HS Specialists share (with primary care providers) highlights from the powerful conversations they have with caregivers, it impacts practice transformation (Davis et al., 2021). As providers hear these stories and learn about their implications for early foundational relationships, they may pay more attention and give credence to any observations of dyadic interactions. For example, they may notice signs of stress and negative attributions toward babies, leading them to bring in the HS Specialist. Providers may also increase their comfort level and improve their ability to recognize signs of trauma and understand its ramifications. A qualitative study of an HS program at the University of Maryland found that primary care providers "attributed the integration of HS with increasing

the prevalence of more person-centered, trauma-informed conceptualizations of children and families and with creating a more welcoming atmosphere" and "a more holistic perspective to understanding health and development" (Davis et al., 2021, pp. 134–135).

What Does Behavioral Health Promotion and Prevention Look Like in Pediatric Care (Using the HS Model)?

As previously illustrated, when HS Specialists spend time with families in the exam room before, during, and after their medical visits throughout the baby's earliest months, there is a great opportunity for behavioral health promotion and prevention.

HealthySteps begins this work by orienting the practice to an IECMH framework. All practice staff are strongly encouraged to participate in training where they are introduced to the HS model and the importance of this approach to preventive care. The all-staff training includes an introduction to early brain development, an overview of attachment theory, toxic stress, and the catastrophic effects of Adverse Childhood Experiences (ACEs) and social determinants of health on infant and toddler well-being. The goal is to inform staff of program requirements (such as universal screenings and the three tiers of service) and to inspire them to join the effort in intervening early in the lives of babies. All practice staff are encouraged to do their part in universal screenings, sharing resources with families, and making referrals (Table 25.A1).

HS Specialists build on this practice-wide IECMH framework when they bring a trauma-informed lens to their work with families. As HS Specialists engage families with kindness, respect, and curiosity, they learn about the trauma families have faced. A HS Specialist may be the first person to learn of trauma, which is often multigenerational. Some practices infuse a trauma-informed care lens formally with staff training. At a community health center in New York, an HS site instituted universal screening for ACEs as part of their formal Trauma-Informed Care (TIC) initiative. Although the medical director initially voiced apprehension at introducing an ACEs questionnaire universally to caregivers with young babies, she agreed after considering the support the HS Specialist would provide. Early in the pilot, the medical director was shocked when a mother endorsed eight ACEs (out of a total possible score of ten). This mother had been her patient years ago when she was a young child. The medical director had provided care for her family for a full generation without knowledge of the adversity and trauma they had been coping with (A. Rich, personal communication, 2017). Primary care providers are frequently humbled by the information gained through screening and eager to connect families to the comprehensive services provided by HS Specialists (Bloomfield et al., 2016). The following vignette illustrates how the HS Specialist can infuse an IECMH lens into primary care, recognize pink (the earliest possible warning signs) and red flags, and more fully support families by connecting them to services early.

Case Example: An HS Specialist met with a father and his son Jayden for a 15-month well-child visit. Jayden's social–emotional screening indicated tantrums that were long and violent, and dad also acknowledged that Jayden was aggressive with his cousins. While dad agreed to meet with the HS Specialist while waiting for his son's vaccines, he did not appear to be particularly concerned about his son's behavior and noted that he too had a short temper and was quick to fight. While engaging Jayden in some play with bubbles, the HS Specialist explored more about his behavior and their family circumstances. Dad mentioned that Jayden's mother had left six months ago, and since then, he had juggled two jobs, piecing together childcare in her absence. The HS Specialist explored how they were coping with mom's absence both concretely and emotionally. Dad noted that he was "too busy to be sad" but had not considered how Jayden might be feeling since he was such a young baby when she left. The HS Specialist shared that all behavior has meaning and wondered if Jayden's aggression and tantrums might be saying some-

thing that he could not express in words. The HS Specialist also acknowledged that the childcare dad had resourcefully cobbled together made it difficult to provide consistent structure, schedule, and rules. Although the HS Specialist was confident that this dyad would benefit from Child–Parent Psychotherapy, dad stated that he did not have time. He agreed to work with the HS Specialist to find an Early Head Start program and explored positive parenting strategies for managing the tantrums and aggression. The HS Specialist also introduced the idea of baby-led play so that they could start having fun together. Shifting this family from a Tier 2 consult to a Tier 3 family,[2] the HS Specialist let dad know she would meet with them when Jayden came in for his future well-child visits through his third birthday. She also encouraged him to reach out sooner if he had concerns before Jayden's next visit.

During these early visits, the HS Specialist was able to plant a seed of some core IECMH concepts for the father (e.g., keeping the baby's perspective in mind and considering that all behavior has meaning) in addition to providing initial concrete support and follow-up with the family in three months. When the HS Specialist shared the key takeaways of this consultation with the referring provider, they were also exposed to these foundational IECMH concepts, and their comfort level in exploring family concerns beyond medical and physical presentations increased over time.

If this father had accepted a referral beyond the pediatric practice, the HS Specialist would provide additional support (often needed, yet rarely available) to successfully connect the family with community services. For example, across a network of HS sites in New York, the referral success rate for the almost 100 families referred to community services was a very high 88% (German et al., 2022). Care coordination, in the same way as all HS services, is provided on a continuum. For some families, a referral and a follow-up call are sufficient. Others may need much more support to access service systems, which are often confounding to navigate.

HS Specialists also support care coordination when they spend time with caregivers discussing hesitancy around referrals. These conversations may happen at the time of referral when caregivers voice questions and/or concerns. It is common for a primary care provider to refer a toddler to EI only to have the patient return visit after visit, month after month, without being connected to services. Caregivers may be hesitant to directly decline the referral, not feeling comfortable telling their trusted physician that they are not interested. HS Specialists can take time to discuss the pros and cons of a referral, explore any hesitation, and work to allay caregiver fears. Further, HS Specialists with strong connections to community services can provide much-needed trust and confidence in referrals.

Case Example: A mother presented her 2-week-old daughter and 18-month-old son at the pediatric practice for a weight check. Although no screening tools had been completed, after meeting with the family and noticing mom's flat affect and limited engagement with her children, the primary care provider connected her with the HS Specialist, who met the family and engaged mom in a discussion about her baby and toddler and her own well-being. Although the mom denied any current symptoms of postpartum depression, she agreed to meet with the HS Specialist at the baby's next visit. The HS Specialist continued to meet with this family during the next several well-child visits, each time talking about typical infant and toddler behavior and development, troubleshooting parenting challenges, and checking in on mom's mood. At the baby's 6-month visit, this mom tearfully acknowledged her depression and history of trauma. She also noted feeling safe with the HS Specialist and was hopeful that she could provide support. She had not wanted to talk about her feelings earlier in the hope they would dissipate. Mom described her current symptoms, and the HS Specialist ruled out thoughts of suicidal/violent ideation and began to explore potential treat-

[2]While practices are encouraged to enroll families into Tier 3 services as early as possible, preferably by the 4-month visit, they can be moved into Tier 3 up to 18 months, when the periodicity of well-child checks become less frequent.

ment options. While mom was still not ready to act, she reported feeling relieved to have acknowledged her depression. The HS Specialist kept meeting with the family during well-child visits and checking in between visits. The subject of her depression and the stigma attached to mental health diagnoses was explored each time, and at the 12-month visit, she agreed to a referral for therapy.

While it took almost a full year to successfully refer mom to therapy, the team-based well-child visits included information and support to potentially mitigate the effects of postpartum depression. Self-care, ways to identify and rely on her support system, and anticipatory guidance were discussed during visits. Visits also included psychoeducation regarding typical development and responses to common behavioral challenges with feeding, sleep, and tantrums—information that may mitigate the damaging effects of maternal depression. While engaging the mom in treatment sooner would have been ideal, the gradual process described above is uniquely possible given HS's integration into the pediatric well-child schedule and suggests that HS can be an effective pathway to a continuum of care that is often out of reach for families.

Making the Case for Alignment Between HealthySteps and IECMH

Workforce Development: HealthySteps as a Vehicle to Build IECMH Capacity

The HS approach starts with a belief that all caregivers have concerns and questions about their child's development and that offering support within the pediatric practice, before a referral to specialty IECMH care is needed, facilitates healthy development in young children by focusing on prevention and strengthening the caregiving unit (Guyer et al., 2003). While IECMH is not yet standard in pediatric primary care, expanding its reach beyond specialty therapeutic intervention can support the well-being of a greater number of families. When all pediatric practice staff better understand IECMH principles and work alongside specialized staff with the IECMH knowledge and/or expertise to implement the principles of behavioral health prevention and promotion, outcomes for children and families improve (Minkovitz et al., 2003).

IECMH Workforce Crisis

The past several decades have led to an explosion of learning about early childhood development, early childhood mental health, and early relational health. As a result, the demand for IECMH services has continued to increase, yet factors such as job security, billable hours expectations, and burnout contribute to turnover in the field (Goldberg, n.d.). A poor reimbursement rate (often due to a lack of payment for prevention) adds a barrier to hiring and sustaining IECMH providers. Nevertheless, there are bright spots in the full continuum of IECMH workforce developments. In the United States, infrastructure to bolster the IECMH workforce has been established via statewide associations that partner with the Alliance for the Advancement of Infant Mental Health, the credentialing entity for the IECMH field (Center for Excellence, 2020). In addition, state Medicaid agencies are finding innovative ways to support dyadic integrated pediatric primary care models by using new billing codes, allowing flexibility in how codes are used, and exploring the use of alternative payment models to support team-based care. Recently, the Centers for Medicare and Medicaid Services (CMS) released an Informational Bulletin to provide guidance to states on the provision of high-quality behavioral health services, including prevention, to children and youth (CMS, 2022).

An additional concern is the dearth of qualified IECMH providers who are culturally attuned and/or matched with the communities they serve. In 2021, the Washington IECMH landscape effort issued a brief summarizing the state of the IECMH consultant workforce and made a case to broaden

the perspective on this work to provide more equitable access to IECMH care (Early Childhood Mental Health Workforce Development Survey, 2021). Having IECMH providers offer various levels of support to assist with social–emotional wellness (promotion, prevention, and treatment), regardless of setting, opens the door for a wider variety of professionals from different educational, cultural, and care backgrounds to be trained in facets of IECMH work.

Preventive Behavioral Health Integration

In addition to HS, programs, such as Behavioral Health Integration for Pediatric Populations (BHIPP), explore the possibility of such work within a wide range of practice types (Talmi et al., 2022). These programs focus on teaching and supporting *existing* pediatric staff in basic principles of IECMH, providing technical assistance as sites introduce screenings, group-based programs, and new systems for coordination of care (Hooker et al., 2022; HRSA, 2017; Talmi et al., 2022). Using existing staff to provide some IECMH services stems from concerns regarding the scarcity and cost of IECMH providers, especially for smaller practices (Lingras et al., 2022).

The rising need for equitable access to IECMH means pediatric care practices must consider multiple avenues to add an IECMH perspective to their care. As such, the HS model allows practices to retrain a current staff member or introduce a new one to serve as the HS Specialist. Because HS Specialists have various educational backgrounds, a common set of principles were needed to uphold quality across HS Specialists and programs. The HS Specialist Competencies ("Competencies"), aligned with existing IECMH consultant (IECMHC) competencies, provide a standard of care for HS Specialists across the network and may serve as a framework for other integrated pediatric behavioral health models focused on young children and their families.

HS Specialist Competencies

The Competencies were developed in collaboration with HS Specialists from across the network to support HS Specialists' efficacy by "clearly defining key knowledge, skills, and attitudes necessary for responsive, culturally attuned, clinical best practices specific to their role" (ZERO TO THREE, 2022, p. 3). The Competencies describe dispositions, knowledge, and skills essential for the ideal HS Specialist. The Competencies: (1) identify content areas for the HS Specialist's optimal skill set, (2) identify discrete knowledge and skills for consideration in reflective supervision, and (3) provide a model for charting professional growth toward becoming a highly competent HS Specialist. The Competencies were written: (1) for HS practices across all settings (urban, suburban, and rural); (2) by HS Specialists from varying educational backgrounds and diverse working experiences; and (3) as "a complement to their discipline-specific professional standards, competencies, and codes of ethics" (ZERO TO THREE, 2022, Introduction, p. 3).

The Competencies are organized into three main categories: the HS Specialist, the Caregiver–Child Relationship, and the Contexts. Each category is seen through two aspects of professional competence: Dispositions (how an HS Specialist *is* with families and colleagues) and Areas of Knowledge and Skills (what an HS Specialist *knows* and *does* to competently fulfill their role). While in practice, these facets of HS Specialist competence are highly integrated, separating them into the Competencies allows HS Specialists and other stakeholders to clearly identify and describe the breadth and depth of exemplary practice in this unique role at the heart of the HS model (Table 25.1).

Infant/Early Childhood Mental Health Consultation Competencies

The Infant Early Childhood Mental Health Consultation (IECMHC) Competencies were developed by Georgetown University's Center

Table 25.1 HS Specialist competencies

	Dispositions	The HealthySteps Specialist
Knowledge & Skills	Area 1: Diversity, Equity, Inclusion, Accessibility & Belonging (DEIAB)	
	Area 2: Child Development & Well-Being Area 3: The Caregiving Relationship	The Caregiver-Child Relationship
	Area 4: Caregiver & Family Well-Being Area 5: Health Care Systems Area 6: Community & Early Childhood Systems of Care Area 7: The HealthySteps National Network	Contexts

for Child and Human Development and colleagues to lay a foundation for national standards on the skills, knowledge, and abilities needed to be a competent IECMH consultant (Center for Excellence for Children's Behavioral Health, 2020). While these competencies were not intended to replace existing local or state IECMHC competencies, they were created to supplement and/or guide efforts to build an "equity-focused, qualified IECMHC workforce" (Georgetown University Center, 2020, p. 3).

The current version of the IECMHC Competencies intends to create a national consensus on the knowledge and skills needed to become an IECMH consultant and acknowledges that while originally created with Early Childhood Centers and home visiting programs in mind, these Competencies "can and should be used in other settings where IECMHC occurs (e.g., pediatric settings, hospitals, homeless shelters, child welfare programs)" (Georgetown University Center, 2020, p. 3). Table 25.2 lists the broad categories found in the IECMHC Competencies; a more detailed version is found in Appendix Table 25.A2.

Alignment: The Infant/Early Childhood Mental Health Consultation Competencies and HS Specialist Competencies

An overall comparison between the HS Specialist Competencies and the IECMHC Competencies indicates distinct common ground across both guiding principles and specific competencies.

Table 25.2 IECMHC competencies

Role of the IECMH consultant	Foundational knowledge
Equity and inclusion	Reflective practice
Child and family focused consultation	Classroom- and home-focused consultation
Programmatic consultation	Systems-wide orientation

Common Ground in Guiding Principles When considering similarities between the HS Specialist Competencies and the IECMHC Competencies, it is necessary to look at the common principles that are interwoven throughout the two documents.

Equity In both, the principle of Diversity, Equity, Inclusion, Accessibility, and Belonging (DEIAB) is described as foundational and used as a lens through which HS Specialists and IECMH consultants are competent in their roles. Knowledge about systemic racism, inequitable access to opportunity, intersectionality, and the historical impact of generational trauma is seen as integral to competence in the roles (Georgetown University Center, 2020; ZERO TO THREE, 2022). In both frameworks, equity principles are Competency categories, with knowledge/skills attached to help consultants and HS Specialists grow in those areas. Both interweave equity principles throughout the other Competency categories.

Reflective Practice One of the foundational principles in IECMH is that of reflective practice (Larrieu, 2009). Present in both competencies,

reflective practice is a fundamental way in which IECMH consultants and HS Specialists can support families as they consider how their own experiences, biases, and identities influence their work. Additionally, both frameworks call attention to the importance of using reflective practice to interact within their clinical setting with colleagues and staff roles (Georgetown University Center, 2020; ZERO TO THREE, 2022).

Relationship-Based Practice Another principle present in both sets of Competencies is honoring the relationship between the child and the family when working in consultation. Relationships are at the heart of the HS model since both children and their caregivers thrive when they are supported by caring professionals. Similarly, IECMH consultants are tasked with understanding the young child's mental health needs by collaborating with their families (Georgetown University Center, 2020). Operating with a strength-based, inclusive approach, both IECMH consultants and HS Specialists take time to consider a child and their family through a broader social context.

Common Ground in Competencies In addition to several shared foundational principles, the sets of Competencies also highlight shared knowledge/skills critical for IECMH consultants and HS Specialists. Below are a few examples:

- ***Dyadic Influences on Healthy Child Development.*** The IECMHC Competencies holds that a core skill for the IECMH consultant is to "Understand that development is a transactional phenomenon, within which infants and young children experience attachment relationships with primary caregivers that play a critical foundational role in development." (Georgetown University Center, 2020, 2B.3.). The HS Specialist Competencies call attention to a similar idea that the HS Specialist needs to understand "the critical role of the caregiving relationship in the physical and mental well-being and optimal development of a child, as well as the wide diversity of forms that healthy, nurturing caregiving relationships can take." (ZERO TO THREE, 2022, 3-K1).
- ***Impact of Early Experiences on Child Development.*** The IECMH consultant collaborates with families and staff to develop a hypothesis about the meaning of a child's behavior, including social–emotional, relational, cultural, and family factors; physical and/or medical issues; environmental factors and events (such as exposure to trauma); and/or developmental vulnerabilities that may play a role in that behavior. (Georgetown University Center, 2020, 5B.1.) The HS Specialist Competencies highlight several knowledge/skill areas with the similar idea that HS Specialists should be aware of "the cumulative nature of early experiences and their potential for both positive and negative impacts on child growth and development" and "the impact of the internal and external factors (e.g., child's physical well-being or emotional state, the physical environment) when assessing/interpreting a child's development and behavior in the exam room" (ZERO TO THREE, 2022, 2-K7; 2-K12).
- ***Recognition of Barriers to Community Care.*** IECMH consultants "Maintain up-to-date information about community resources. Limit unnecessary barriers that prevent families from accessing services by making effective referrals" (Georgetown University Center, 2020, 8B.2). The HS Specialist Competencies similarly outlines the importance of understanding: "The early childhood system of care in the community, including how HS fits into that system of care" and "Institutional barriers that interfere with families accessing services in the community, including institutional racism and inequity" (ZERO TO THREE, 2022, 6-K1; 6 K-2).

Table 25.3 provides a high-level crosswalk between competency categories from the IECMHC and HS Specialist Competencies.

Differences in the Competencies Despite many areas of overlap, there are distinctions between the competencies. HS Specialists' roles are defined differently from those of an IECMH con-

HS Specialists Competencies	IECMH Consultation Competencies
Dispositions	Role of the IECMHC Reflective Practice
DEIAB	Equity & Cultural Sensitivity
Child and Development Well-Being	Foundational Knowledge Child and Family Consultation
The Caregiving Relationship	Child and Family Consultation Classroom/Home Consultation
Healthcare systems	Classroom/Home Consultation Programmatic Consultation Systems-Wide Orientation
Community and Early Childhood Systems of Care	Child and Family Consultation Systems-Wide Orientation

Table 25.3 Crosswalk between HS Specialist competencies and the IECMHC competencies

sultant. The HS Specialists' role is largely focused on the prevention arm of IECMH.[3] HS Specialists work preventively to recognize and address pink flags and provide care and anticipatory guidance. Families requiring more in-depth mental health support are referred to IECMH consultants and therapists for treatment.

Another significant difference between the roles of the HS Specialist and the IECMH consultant is that of their integration within the pediatric team. The HS Specialist is an integrated part of the pediatric team, a working partner with providers during well-child visits, addressing elevated screenings, and offering anticipatory guidance for families. IECMH consultants do not work solely in pediatric settings, and when partnering with pediatric clinics, they typically operate more as referral partners whose work is seen through consultations and whose role may be limited. Together, the HS Specialist Competencies and the IECMHC Competencies overlap to create a continuum of care, expanding the IECMH field to reach more children and families.

Conclusion

The principles of IECMH that promote emotional well-being and prevent behavioral health problems can and should be expanded to the pediatric primary health care arena. This approach provides a unique and equitable opportunity to reach most children and their caregivers and support them to reach their full potential. Using a population health lens, HS, with its tiered, risk-stratified approach, is one model working to embed IECMH principles and transform the promise of primary care pediatrics in the United States. Eliminating barriers, providing early access, and offering additional support, HS improves the experience of caregivers and providers (Guyer et al., 2003) and promotes health equity in comprehensive and meaningful ways.

HealthySteps aims to bridge the gap created by workforce struggles where there are limited IECMH specialty providers to refer to and a lack of IECMH knowledge and expertise within other systems. HS Competencies were created to standardize the approach of HS Specialists, align their work with the larger field, and provide a blueprint for further integration of IECMH into primary care. This chapter presented an overview of HS and IECMHC competencies, demonstrating alignment with a shared emphasis on equity, reflective practice, and relationship-based practice. This crosswalk clearly locates HS within the continuum of the IECMH field, focused mainly on prevention and promotion. The broadest possible reach for an IECMH continuum of care is needed if babies and toddlers are to receive the interventions necessary for the best trajectories and outcomes, and ought to be the new standard for pediatric care, and those systems that have the potential to reach significant numbers of children.

[3]While HS Specialists are not required to be IECMH endorsed, many are able to incorporate IECMH consultation and treatment into their HS programs (e.g., parenting groups, caregiver MH sessions).

Appendix

Table 25.A1 Overview of HS Specialist competencies

Competency area	Knowledge statement
Dispositions	Dispositions remind us that "how we are is as important as what we do" (Pawl & St. John, 1994). Dispositions are the values, attitudes, and beliefs that underlie HS Specialists' role-specific knowledge and skills. At the heart of these qualities is relationship—the intention and ability to develop relational trust and encourage effective communication between families, the HS Specialist, and the HS team. Dispositions extend beyond the ability to inclination—the inclination to create a safe and supportive space for children and families that also places diversity, equity, inclusion, access, and belonging at the nexus of the work.
Area 1: Diversity, Equity, Inclusion, Access, & Belonging (DEIAB)	A competent HS Specialist grounds their practice in a solid understanding of the following concepts/facts, causal relationships, and processes: 1-K1. The presence and impact of individual differences, perspectives, and cultural assumptions of each person in the exam room, including the HS Specialist; the benefit to care teams of diverse perspectives on the team and how to identify missing perspectives and fill those gaps when possible 1-K2. The presence and validity of diverse parenting beliefs and practices, as well as effective approaches to working with families to explore implications and alternatives for meeting the child's full range of needs 1-K3. The critical roles of culture, race, and language in perceptions of development and health and engagement in the systems that serve young children and families 1-K4. The roots of oppression and exclusion embedded in all systems that continue to cause harm and marginalize groups of people and create barriers to health care, help-seeking, and relationship-building (Crowley, 2010); the time and effort needed to discover and overcome barriers such as mistrust and stigma 1-K5. The presence of both recent and generational traumas, particularly those related to health care, in the room at each family's visit; the importance of acknowledging these traumas when working with the family to understand and engage with them in setting a pace that fits their needs and interests 1-K6. The position of power and privilege that HS Specialists hold as part of the medical team and, therefore, the responsibility they have to advocate for families and work toward diverse, inclusive, and equitable spaces that improve access and a sense of belonging for everyone

Competency area	Knowledge statement
Area 2 Child development & well-being	A competent HS Specialist grounds their practice in a solid understanding of the following concepts, causal relationships, and processes: 2-K1. Progressions and milestones of typical development from prenatal through age 3, including each of the domains of development: • physical and sensory development • gross and fine motor development • cognitive development • language, communication, and emergent literacy • social–emotional development, including emotional and behavioral regulation 2-K2. Principles of infant–early childhood mental health 2-K3. *How cultural knowledge and identity develops in and influences children* 2-K4. Individual differences in development and manifestation of those differences in behavior, potential causes of differences, and indications that referral for further assessment and possible intervention is warranted 2-K5. Early (prenatal through age 3) brain development, including factors essential for optimal development and factors that put brain development at risk
	2-K6. The basic principle of epigenetics (gene-environment interaction) and the implications for understanding children's development and behavior 2-K7. The cumulative nature of early experiences and their potential for both positive and negative impacts on child growth and development 2-K8. Dimensions and characteristics of temperament and how temperament influences children's behavior and relationships 2-K9. Attachment theory and key concepts/behavioral indicators of attachment quality 2-K10. The importance and role of child-directed exploration and play for development and learning 2-K11. *The application, interpretation, and limitations of developmental screenings, including implications of language and culture* *2-K12. The impact of the internal and external factors (*e.g.*, child's physical well-being or emotional state, the physical environment) when assessing/interpreting a child's development and behavior in the exam room* *2-K13. Types of stress in early childhood, the impact of toxic stress and trauma on infant mental health, buffers to negative impacts of stress and trauma, and resiliency*

Table 25.A1 (continued)

Competency area	Knowledge statement
Area 3 the caregiving relationship	A competent HS Specialist grounds their practice in a solid understanding of the following concepts, causal relationships, and processes: 3-K1. The critical role of the caregiving relationship in the physical and mental well-being and optimal development of a child, as well as the wide diversity of forms that healthy, nurturing caregiving relationships can take 3-K2. *The role of race and culture in caregiving practices and familial relationships, as well as the intergenerational transmission of racial and cultural identity and belonging* 3-K3. The fundamentals of relationship-based practice as a cornerstone of the HS model 3-K4. The serve-and-return dynamic of optimal everyday interactions between child and caregiver and the cumulative impact of interaction quality over time on the development of the relationship between child and caregiver 3-K5. Indicators, from both child and caregiver, of attunement and attachment quality 3-K6. Strategies for fostering curiosity and reflection as positive parenting practices 3-K7. *The progression of development of identity as a new caregiver and the unique opportunity that a new baby opens for caregivers to consider/reconsider knowledge and skills in caregiving* 3-K8. Evidence-based caregiving practices that support optimal child health, development, and well-being (e.g., feeding, sleep, toileting, response to crying, early learning) 3-K9. A range of positive parenting strategies, including strategies specific to children exposed to trauma or where there are concerns about attachment 3-K10. Factors that increase the risk of a caregiver's maltreatment of their child and protective factors that reduce risk and build caregivers' resilience 13-K1. Child injury risk factors and recommended prevention measures (e.g., shaken baby, car seat safety, safe sleep, choking hazards, baby equipment) 3-K12. Caregiver mental and physical challenges and disorders that can negatively impact caregiver–child interactions or caregiver's emotional availability

Competency area	Knowledge statement
Area 4 Caregiver & family well-being	A competent HS Specialist grounds their practice in a solid understanding of the following concepts, causal relationships, and processes: 4-K1. How to develop strong collaborative relationships with caregivers/family members that foster healthy family relationships, positive caregiving, and family well-being goals 4-K2. Characteristics and impacts of a strength-based perspective toward caregivers and family systems 4-K3. *Family systems and caregiving/family practices within an intersectional cultural context* 4-K4. *The value of communicating with each family in their preferred language(s); available language resources and how to make use of them when needed* 4-K5. A reflective practice approach to talking with caregivers/family members about family interactions and dynamics 4-K6. The positive impact of a community-based support system (e.g., friends, faith community) on caregiver and family well-being 4-K7. The negative impact of trauma and toxic stress (e.g., adverse childhood experiences [ACEs]) on family and intergenerational well-being 4-K8. Social determinants of health (SDOH), their connection to family/caregiver well-being, and approaches and resources to alleviate negative impact 4-K9. *The impact of caregiver/family mental health and substance use challenges on infant/child development and Well-being, and the importance of carefully weighing cultural factors when assessing for such challenges* 4-K10. Assessment and treatment options for caregiver/family mental health and substance use challenges, including perinatal mood and anxiety disorders 4-K11. Assessment of a caregiver/family member's ability to refrain from self-harm or unsafe behavior toward the infant/child or others and associated planning and referral 4-K12. Warning signs and varying manifestations of intimate partner violence, as well as the impact of the cycle of abuse and the underlying relational imbalance of power and control 4-K13. Legal definitions and warning signs for types of abuse and neglect, as well as associated legal reporting requirements and institutional protocols
Area 5 health care systems	A competent HS Specialist grounds their practice in a solid understanding of the following concepts, causal relationships, and processes: 5-K1. Professional practice guidelines, regulations, and laws, such as Bright Futures Guidelines (Hagan et al., 2017), the Healthcare Privacy and Portability Act, and Child Welfare standards that inform team-based patient care and decision-making 5-K2. A basic vocabulary in medical terminology and relevant diagnoses 5-K3. Health screens, medical procedures, and referral processes relevant to delivering HealthySteps services 5-K4. The sensitive nature of personal information about the family recorded in the child's medical chart, such as caregiver mental health concerns or histories of trauma 5-K5. The role of an HS Specialist as an equal and significant member of the care team where differences of opinion in care planning can and should be diplomatically shared for optimal patient care 5-K6. The scope of work of each care team member, including the overlap and distinctions in professional knowledge and roles/responsibilities across the interdisciplinary care team 5-K7. Operational workflows from the patient and staff perspective that include the HS Specialist's work 5-K8. The culture and history of primary care that centers the pediatric primary care provider as the care team lead and how elevating the role of HS specialist as a care team provider supports optimal patient care and outcomes while also increasing provider satisfaction 5-K9. *The impact and outcomes of both historic and current structural racism and oppression in medicine and how that history manifests in provider–patient relationships, family engagement in care, and health disparities, especially as it relates to the manifestation of power and privilege with patients and care team members* 5-K10. The role of evidence-based practice and data-driven methodology in assessment and decision-making 5-K11. The concept of continuous quality improvement (CQI) and how an HS Specialist contributes to CQI in their clinical setting

Table 25.A1 (continued)

Competency area	Knowledge statement
Area 6 community and early childhood systems of care	A competent HS Specialist grounds their practice in a solid understanding of the following concepts, causal relationships, and processes: 6-K1. The early childhood system of care in the community—Including how HS fits into that system of care 6-K2. *Institutional barriers that interfere with families accessing services in the community, including institutional racism and inequity* 6-K3. *Previous experiences families may have with other systems, including traumatic experiences, that may inhibit a family from re-engaging with those systems* 6-K4. *The impact of SDOH on health, development, and overall well-being of young children and their families* 6-K5. Referral processes for individual community agencies 6-K6. Resources and supports in the community that help address family needs and SDOH
Area 7 the HealthySteps National Network	A competent HS Specialist grounds their practice in a solid understanding of the following concepts, causal relationships, and processes: 7-K1. The HS evidence-based model, relationship-based approach to supporting optimal child development, and anticipated outcomes for children and families who receive HS services 7-K2. The role and resources of the National Office and network of practices in informing and serving as a support for HS Specialists and the transformation of primary care practice sites 7-K3. The fidelity metrics, data collection, and reporting requirements for all HS sites and the team members responsible for contributing to them at one's site, including one's own responsibilities 7-K4. HS is a program of ZERO TO THREE, an organization that endorses specific professional and scientific practice approaches, promotes public policies that support young children and their families, and provides professional resources that align with those approaches and policies

Note: Italicized statements reflect or include a DEIAB lens

Table 25.A2 Overview of the IECMHC competencies

Categories	Summary of IECMH consultant skills
Role of the IECMH consultant	Understands and can convey how IECMHC is a mental health specialization and service that is distinct from other activities in which mental health professionals may engage. Demonstrates an ability to strengthen the capacity of staff working in programs and other settings serving infants, young children, and families to support the social, emotional, and relational health of infants, young children, and families in a range of settings. Partners with families and staff in working to prevent mental health problems from developing or worsening and/or in responding effectively to existing mental health concerns. Partners with staff and program or other setting and systems leaders to build more equitable systems by addressing implicit bias, increasing positive relationships between early childhood providers and infants and children with different abilities and from diverse racial/ethnic and language backgrounds
Foundational knowledge	Draws from a broad and diverse knowledge base to understand infants, young children, families, and staff with different abilities and from diverse racial/ethnic and language backgrounds, and how they relate to one another. Turns to a variety of disciplines and theories to inform the direction of consultation.
Equity and inclusion	Understands broad and local historical and systemic dynamics that have generated racialized disparities in outcomes for infants, young children, and families. Works with others to improve their understanding of how infants, young child, and adult race/ethnicity, primary language, culture (beliefs, values, voice, communication style, behavioral norms, and attitudes), abilities, biases, disposition, and life circumstances (e.g., poverty and domestic violence) impact the learning environment. Additionally, understands how adult–infant/young child interactions shape the quality of relationships, infants' and young children's learning experiences, and disciplinary decisions but also how contextual variables such as community context, history, and systems shape adults' and infants'/young children's experiences. Explicitly and intentionally acts on this understanding to create equitable and positive experiences for all infants and young children, including those from historically marginalized and oppressed communities.
Reflective practice	Thinks about and questions personal biases, assumptions, and experiences before, during, and/or after consultative interactions. Considers the influences on and perspectives of others (e.g., infants, young child, family, staff) in the context of consultation, including how these may vary based on infant, young child, family, staff, and consultant ability, race/ethnicity, and language background (i.e., "what might this experience have been like for the infant, young child, staff member, or caregiver?"). Promotes reflective practice with consultees, using this experience-based learning to support consultees' professional growth and development. Commits to a journey of ongoing self-exploration to understand how one's culture, background, race, and other social identities (including issues related to privilege and power) impact the way IECMH consultants see themselves and others.

(continued)

Table 25.A2 (continued)

Categories	Summary of IECMH consultant skills
Child- and family-focused consultation	Collaborates with families and/or programs or other setting staff to understand and respond effectively to an infant's or young child's mental health needs, behavioral difficulties, and/or developmental challenges or to a caregiver's mental health needs. Partners respectfully with families and staff to understand the context and nature of a particular family's life to enhance the infant's, young child's, and family's well-being. Takes time to understand how race/ethnicity, primary language, culture, abilities, disposition, and life circumstances (e.g., poverty and domestic violence) influence the infant's, young child's, or family's experiences and the program's or other setting's and system's role in hindering or supporting wellness. Resists applying a deficit-based perspective to infants, young children, and families who are from historically marginalized and oppressed communities by committing to learning about authentic community strengths and adaptive responses to poverty, historical trauma, and other racialized experiences
Classroom- and home-focused consultation	Collaborates with families and program staff to promote equitable, warm, and trusting relationships, consistent routines, and development-enhancing interactions that positively impact program and home climates. Understands and values the roles that race/ethnicity, primary language, culture, abilities, disposition, and life circumstances play in supporting infants' and young children's social and emotional development and incorporate a family's culture and primary language into non-home settings to build continuity for infants and young children into their experiences at home and in other settings (e.g., classrooms).
Programmatic consultation	Maintains a systemic approach and aims for program-wide impact through a focus on multiple issues that affect the overall quality and equity of programs or settings serving infants, young children, and families. Works to enhance programmatic functioning by assisting program administrators and/or staff in considering the program's or setting's overall social and emotional climate; solving issues that affect more than one infant or young child, staff member, and/or family; collecting and using disaggregated data to track program-wide disparities in both opportunity and the ways in which young children are disciplined, and supporting the development and implementation of policies that create more equitable experiences for infants, young children, and families
Systems-wide orientation	Works within and across systems, integrating equity and mental health concepts and supports into the environments where infants and young children spend time. Maintains awareness of the systems within which IECMHC occurs and considers these contexts when seeking to understand factors that promote or hinder the process of change. Works to strengthen bridges between systems serving infants, young children, and families to facilitate access to comprehensive and integrated care.

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The Effects of Trauma on Parenting and Caregiving

26

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Exposure to trauma in infancy and early childhood is common and has negative effects on the brain as well as impacts on the social, emotional, and cognitive development of young children. Such trauma exposure can also have a potentially long-term influence by affecting the ability of the next generation to provide positive parenting to their own children.

The deleterious impact of trauma on children and their subsequent capacity to parent their own children is well recognized in the clinical community and has been examined empirically both in the United States and internationally (Cho et al., 2021; Madigan et al., 2019). Furthermore, there is evidence that parenting experienced by trauma-exposed children may attenuate the impact on young children's functioning.

Thus, the overarching purpose of this chapter is to consider the role of parenting and the impact of trauma exposure on young children. We begin by presenting a brief overview of current knowledge about epidemiology and the effects of exposure to trauma on infants and young children. Then, how parenting influences the impact of trauma on children is explored, focusing primarily on trauma emanating from interpersonal and community violence. Additionally, we consider the inequities contributing to the effects of trauma on young children and the parenting they experience. Finally, we offer recommendations for systemic treatment modalities and multidisciplinary program designs to promote positive parenting in families affected by trauma.

Background: Definitions, Conceptualizations, Epidemiology, and Sequelae of Trauma

According to the National Child Traumatic Stress Network (NCTSN), a traumatic event is "a frightening, dangerous, or violent event that poses a threat to a child's life or bodily integrity" (NCTSN, 2003). NCTSN categorizes traumatic experiences into three groups: acute trauma (i.e., incidents that occur once), chronic trauma (i.e., incidents that are persistent), and complex trauma (i.e., chronic traumatic events that are of an interpersonal nature). Acute traumatic events may include natural and technological disasters, serious accidents, or mass violence. Chronic events may be life-threatening illness; community violence; sudden or violent loss of a loved one (given the sustained experiences related to a family grieving); substance use exposure; refugee and

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war experiences (including torture); and military family-related stressors (e.g., deployment and parental loss or injury). Complex traumatic experiences include those in which young children are directly victimized, including physical, sexual, or psychological abuse and neglect.

According to the federal Child Abuse Prevention and Treatment Act (CAPTA) (P.L. 100–294; P.L. 111–320; Child Welfare Information Gateway, 2019), the definition of child abuse and neglect is "at minimum, any recent act or failure to act on the part of a parent or caretaker which results in death, serious physical or emotional harm, sexual abuse or exploitation; or an act or failure to act, which presents an imminent risk of serious harm." Child physical abuse typically entails some form of physical assault (e.g., bruising, choking, biting, burning, or causing bone fractures or trauma to the head or abdomen) (Dubowitz & Bennett, 2007). Although controversial, some trauma experts include corporal punishment as an aspect of physical abuse.

Child sexual abuse is defined as inappropriate sexual acts with children that are for the gratification of an adult or an older child, including oral, genital, and rectal contact, exposure to sexual anatomy, and the use of a child for pornographic purposes. Child neglect, the most common form of maltreatment, is strongly related to poverty and is defined as parent/caregiver failure to meet children's basic needs, provide adequate supervision, and protect children from harm, and includes environmental, medical, educational, or supervisory neglect. Finally, emotional abuse, a form of maltreatment that is hard to identify (Herrenkohl, 2016), occurs when a child experiences hostile, harsh, belittling, spurning, terrorizing, isolating, exploiting, and/or corrupting treatment.

Epidemiology

Because of its prevalence in the United States, trauma represents a significant public health issue. Recent research using the Diagnostic Statistical Manual, fifth edition, found that 89.7% of individuals in the United States have experienced a traumatic event at some point in their lives (Kilpatrick et al., 2013). While prevalence estimates of very young children's exposure to potentially traumatic events are limited, Briggs-Gowan et al. (2010) examined the lifetime prevalence and correlates of non-interpersonal exposure to traumatic events and violence in a representative healthy birth cohort (aged 1–3 years) coming from an urban and suburban region of the United States (37.8% minority and 20.2% poverty). By 24–48 months of age, the prevalence of exposure was 26.3% (14.5% non-interpersonal and 13.8% violence) and was more common among children living in poverty (49.0% overall, 19.7% non-interpersonal, and 33.7% violence). The most consistent factors associated with trauma exposure were poverty, parental depressive symptoms, and single parenting.

There is robust evidence that young children are more likely to be exposed to complex trauma, particularly maltreatment. Recent national data reveal that almost half of maltreatment victims are 5 years of age and younger with the highest victimization rates for infants under one year of age (Administration for Children and Families, 2022). Furthermore, children under 5 are most likely to experience the trauma of family separation due to foster care placement (Administration for Children and Families, 2023). These findings underscore the importance of advancing a public health perspective by preventing young children's exposure to trauma in early childhood and implementing interventions to protect them and reduce subsequent violence.

Service providers, teachers, and caregivers are valuable sources of information about children's exposure to traumatic events. For example, in a survey of clinicians participating in the National Child Traumatic Stress Network (NCTSN), it was found that 77.6% of the children and adolescents that they had assessed and treated for traumatic stress reactions had experienced prolonged exposure to multiple traumatic events (Spinazzola et al., 2005). Clinicians reported that interpersonal victimization in the home was the most prevalent type of trauma experienced by treatment-seeking and referred patients. They

reported that trauma not involving interpersonal violence, such as serious transportation accidents and natural disasters, was far less prevalent among children and adolescents provided trauma-focused treatment (Spinazzola et al., 2005).

While trauma exposure for young children happens across the world, there are inequities in exposure in that certain groups of children experience higher rates of trauma. For example, substantial research underscores that children from low-income backgrounds experience higher rates of trauma. They are more likely to experience natural disasters and community violence (Leiberman-Cribbin et al., 2021), as well as racialized trauma via direct or vicarious discriminatory experiences (Heard-Garris et al., 2018). Complex trauma, specifically child maltreatment, is also more prevalent among low-income communities. The strong relationship between poverty and child maltreatment has been well documented, especially regarding child neglect (Administration for Children and Families, 2022; Putnam-Hornstein et al., 2021). Similarly, children from low-income backgrounds are more likely to be involved in the child welfare system (CWS) than their middle-class counterparts (Drake & Jonson-Reid, 2014). Given that the large proportion of child welfare involves families who are from lower socioeconomic backgrounds, families of color, particularly African Americans, are disproportionally represented in the CWS (Detlaff & Boyd, 2020).

Harris et al. (2011) identified groups of children who are at high risk for exposure to trauma, including (1) children who are known to have been abused or neglected; (2) children in out-of-home placement; (3) children exposed to intimate partner violence or who witness the violent death of a parent, caregiver, sibling, or friend; (4) adolescent parents; (5) children in the juvenile justice system; (6) children who are victims of catastrophic accidents or mass casualty events, including those associated with school violence, terrorism, or natural disasters; (7) children from countries that have had or are having major armed conflicts or civil disturbances; and (8) children who require residential treatment or hospitalization for certain mental health or behavioral problems, such as substance abuse or suicide attempts. Thus, some children face the "double jeopardy" of being young and part of marginalized or at-risk groups that render them even more susceptible to trauma exposure.

Sequelae of Trauma Exposure: Given that young children rely on their primary caregivers and other adults for their sense of safety and security, trauma exposure, especially when caregivers are involved or affected, can be particularly deleterious to them. Many factors contribute to poor longer-term outcomes following trauma exposure including degree of exposure, economic consequences, family stressors, community disruption, continued crises, and additional losses and traumas. The COVID-19 pandemic provides a prime example of how additional risk factors play a role in response and recovery to trauma. Children from low-income and minority backgrounds are more likely to be in families experiencing economic problems leading to increased stress, accompanied by severe physical illness and death of family members as a result of COVID-19, which may further exacerbate the sequelae they have from this traumatic event.

Essentially, trauma exposure affects children across health and developmental domains. Emerging research has documented the impact of trauma on the brain and facets of the physiological system. Research has shown that exposure to trauma results in overall damage to brain functioning, smaller brain volume, larger fluid-filled cavities, less connective matter, and impaired growth and functioning of brain areas involved in thinking and emotions, including the hippocampus, amygdala, and prefrontal cortex. Studies focused on the hypothalamic–pituitary–adrenal (HPA) system suggest that trauma exposure may lead to altered diurnal patterns of the production of the stress hormone cortisol. Furthermore, trauma may affect the immune system in children, leading to physical illnesses such as asthma and allergies (Danese & Lewis, 2017).

Other physical sequelae of trauma include impacts on sleeping and eating patterns as well as changes in activity level and motor skills. Due to the stress of trauma, some children regress and begin to have toileting problems (e.g., bedwet-

ting). Furthermore, children who are maltreated and exposed to other aspects of physical trauma may experience injury or, in severe cases, death. These early physical health sequelae may lead to long-term impacts on adult health and well-being (Springer et al., 2007).

Although not studied as extensively, trauma also affects children's cognition, language, and academic functioning (Kavanaugh & Holler, 2014). Children exposed to trauma may display developmental delays, cognitive and language impairments, and executive functioning challenges such as inattention, poor memory, and dysregulation (Kavanaugh & Holler, 2014). These delays and impairments may lead to academic challenges, such as lower levels of school readiness and compromised academic skills (Romano et al., 2015).

There is a large evidentiary base regarding the impact of trauma on children's social–emotional development and mental health, even for very young children. Research has documented that trauma-exposed children may experience emotion dysregulation and increased distress sensitivity to non-stressful events. They may also display internalizing problems, such as anxiety, depression, clinginess, and fearfulness, as well as externalizing problems, such as tantrums, oppositionality, defiance, and aggression. According to the National Child Traumatic Stress Network (2003), some children demonstrate prolonged and intense reactions to trauma that lead to "traumatic stress" (or developmental trauma) disorder. Children with "traumatic stress" show symptoms such as reexperiencing trauma (e.g., flashbacks and nightmares), numbing (e.g., social withdrawal and play constriction) and increased arousal (e.g., attention problems, hypervigilance, and symptoms of PTSD). They may also display novel symptoms, such as aggression, sexualized behavior, new fears, and loss of developmental milestones (DC:0–5). As with physical health, these early mental health sequelae of trauma exposure may lead to long-term effects on adult mental health and well-being (Springer et al., 2007).

Theoretical/Conceptual Underpinnings of Parenting in the Context of Trauma

Multiple theories can be applied to a consideration of parenting in the context of trauma. For example, conceptualizations emanating from the bioecological theory of human development (Bronfenbrenner & Morris, 2006) emphasize the importance of examining systems of support for these families, including services and policies, as well as cultural processes that may attenuate the effects of trauma exposure on parenting and child outcomes (Korbin, 2002). Belsky devised the ecological–transactional theory of parenting and posited that parenting processes are based on (1) parents' experience of parenting, (2) characteristics of children, and (3) familial contexts (e.g., intergenerational maltreatment, parental stress and mental health, family conflict/violence, and financial hardship (Belsky & Jaffe, 2015).

Much of the research on parenting in the context of trauma is grounded in attachment and social-information processing theories. Attachment theory posits that a stable and secure relationship with a caregiver beginning in infancy allows for the development of a firm sense of self and associated positive developmental outcomes (Bretherton, 1992; For children exposed to acute trauma, the attachment relationship provides a "secure base," which protects them from the vestiges of these traumatic events. Parenting from a caregiver providing this secure attachment, whether a parent, relative, or foster parent, makes a significant difference for the child.

From the perspective of social-information processing theory, children process trauma from sensory (i.e., register experience), perceptual (i.e., classify experience), and cognitive (i.e., attach meaning to experience) levels, all of which contribute to their memory of the traumatic event (Hartman & Burgess, 1993). The parenting children experience contributes to the way they process trauma before, during, and after the traumatic event (Appleyard & Osofsky, 2003). Social information processing theory can also be applied to the parenting of children who are the direct victims of trauma (i.e., are maltreated). As Azar

et al. (2012, 2017) posit, maltreating parents may have social-cognitive deficits that diminish their capacity to have developmentally appropriate expectations of their children, to refrain from attributing negative intentionality to children, and to adapt their behaviors and problem-solve in the context of parenting.

Extant conceptualizations of trauma and parenting point to the critical role of parental functioning. For example, in their conceptualization of parenting in the context of Intimate Partner Violence (IPV), Levendosky and Graham-Bermann (2001) argue that maternal psychological functioning, such as depression, anxiety, and posttraumatic stress, attenuates the impact of the parenting context (i.e., violence) on maternal parenting behaviors. Furthermore, Banyard et al. (2003) proposed that maternal depression mediates the relationship between maternal exposure to past (e.g., child maltreatment) and current (e.g., IPV) trauma and parenting cognitions and behaviors.

There is evidence that parental Post-Traumatic Stress Disorder (PTSD) results in more negative parenting practices, such as harsh, overprotective, and role-reversing parenting styles (Bryant et al., 2018). Wilcoxon et al. (2021) emphasize that PTSD has such a debilitating effect on parental well-being that it is difficult for parents to be sensitively attuned toward their children. In a study on child single-event event trauma, it was documented that parents can experience PTSD after their child has experienced assault, life-threatening illness, burns, accidents, or traffic collisions. Poor social support, scant employment opportunities, low socioeconomic status, and other structural and systemic factors are often associated with adults that are diagnosed with PTSD (Wilcoxon et al., 2021). Overall, the cumulative impact of parental PTSD, poverty, and limited social support compromises the quality of parenting that traumatized children experience.

The combination of depression and trauma can have a deleterious impact on parenting. For example, Swartz et al. (2018) argued that children of mothers who experience depression and trauma have increased chances of developing insecure attachment because of inconsistent, inattentive, or insensitive parenting styles. In a study of reported and observed parenting behaviors, Muzik et al. (2017) found that maternal depression was associated with intrusive and disengaged parenting. However, mothers in this study with both depression and trauma symptoms reported impaired parenting but displayed parenting that was as sensitive as that of nondepressed mothers. In a study of women who had a history of being maltreated, Wolford et al. (2019) documented that mothers with depressive symptoms were more likely to use psychological and physical aggression toward their children.

Trauma Exposure and Parenting

The National Child Traumatic Stress Network (2022) underscores that the family and broader caregiving system have a critical role in the experience and sequelae of trauma for young children and are also affected by children's experiences of trauma. Although there is variability in the type, severity, and effects of trauma exposure, the preponderance of evidence points to a relationship between trauma exposure and parenting practices and behaviors (Christie et al., 2019). Often, parenting acts as a mediator between the impact of trauma on children's outcomes (Gewirtz et al., 2008), such that trauma-exposed children who experience more positive parenting may not display the same level of negative outcomes as their counterparts who experience negative parenting (Lindstrom Johnson et al., 2018). In the following sections, we explore the literature on parenting in the contexts of acute trauma, chronic trauma, complex trauma (i.e., child maltreatment), and intergenerational trauma.

Acute Trauma and Parenting Acute trauma is characterized by a singular trauma event that occurs in one's lifetime, such as an incident of mass violence. The data on parenting in the context of acute trauma are almost nonexistent. In one study, Valentino et al. (2010) documented that for children who had experienced a traumatic event, hostile and coercive parenting was

associated with their functioning, including child posttraumatic stress disorder (PTSD), internalizing symptoms, and personal adjustment. In their qualitative study of parenting in the context of single-event trauma, Alisic et al. (2012) highlighted the role of responsive parenting, including being aware of and acting upon the child's needs for children exposed to trauma. Furthermore, Chrisman and Dougherty (2014) found that parental support is an important protective factor for children exposed to mass violence.

Chronic Trauma and Parenting Much of the literature on chronic trauma pertains to children's and families' exposure to violence, with some studies addressing its impact on parenting. Typically, these studies examine trauma exposure emanating from war and community violence within neighborhoods. For example, in a study addressing political violence in Israel (Zamir et al., 2020), mothers who were exposed to high levels of violence had higher rates of PTSD, which affected their parenting practices. Specifically, violence-exposed mothers demonstrated higher levels of observed coercive parenting practice (e.g., harsh parenting practices and inconsistent discipline), which was related to children's behavior problems. Similarly, Bryant et al. (2018) found that PTSD in refugees in Australia led to harsher parenting styles that negatively impacted child outcomes, leading to such behavioral issues as child conduct problems, hyperactivity, and peer problems.

Community Violence Exposure Children's exposure to community violence in their neighborhoods is another source of trauma that has been extensively examined in the United States, with multiple studies addressing the role of parenting. For example, there is evidence that mothers with higher levels of community violence exposure (CVE) are much more likely to engage in physically and psychologically aggressive parenting practices compared to mothers with no violence exposure. Their parenting behaviors mediated the impact of CVE on their adolescents' behavioral outcomes (Zhang & Anderson, 2010). A similar study (Spano et al., 2009) suggested that CVE negatively impacted parenting processes (e.g., rules and monitoring), which affected child outcomes. Chen and Lee (2017) documented that witnessing community violence, rather than direct victimization, was related to maternal reports of physical and psychological aggression toward their children. In a later study (Chen & Lee, 2021), these authors found that maternal psychologically aggressive parenting mediated the impact of CVE on children's behaviors, whether they were indirectly (e.g., witnessing) or directly victimized. Similarly, Zhang and Eamon (2011) documented the mediating role of psychologically and physically aggressive parenting with respect to the impact of CVE on child aggression.

The literature on CVE has asked more nuanced questions with respect to the role of parenting, such as whether the level of parental involvement and monitoring modified the relationship between CVE and child outcomes. For example, Hamner et al. (2015) found that in situations with high levels of parental involvement, there was a positive association between CVE and adolescent aggression. In contrast, Ceballo et al. (2012) found that parental monitoring positively affected child well-being when there was lower violence exposure, but not in situations of high CVE.

Finally, Evans et al. (2023) examined the impact of both CVE and Adverse Childhood Experiences (ACEs) on children's health and development. They argue that children who have experienced ACEs are more likely to experience CVE and as such are more likely to have negative health and developmental outcomes. In their longitudinal study, they found that parental involvement moderated the direct relationship between ACEs and indirect ECV, suggesting that parenting can buffer traumatized children against future trauma.

Parenting Processes in Families Affected by Complex Trauma

Intimate Partner Violence Although children may be indirectly or directly affected by Intimate Partner Violence (IPV), the chronic and interpersonal nature of the violence may render it a form

of complex trauma. Furthermore, parenting may be affected by the stress and conflict emanating from IPV, leading to negative child outcomes. In a review of IPV impacts on parenting practices, Sousa et al. (2022) documented that mothers who are victims of IPV are less able to provide attachment experiences, warmth, positive discipline, and appropriate control and monitoring of their children. Victims of IPV may also exhibit less emotional availability and harsher responses to their children, mirroring the behaviors to which they are exposed in their relationships with IPV perpetrators or due to their own emotional exhaustion (Sousa et al., 2022). Furthermore, IPV victims may display harsher disciplinary practices as a way to protect their children from victimization by the IPV perpetrator (Sousa et al., 2022). Aligned with these findings, Grasso et al. (2016) found that physical and psychological forms of IPV were predictors of physical and psychological aggression toward children. Similarly, Chen and Lee (2017) found that maternal experience of psychological IPV, but not physical IPV, was related to maternal harsh parenting practices.

Maternal functioning may also attenuate whether and how IPV affects their parenting behaviors. For example, Levendosky and Graham-Bermann (2001) found that the effects of women's negative psychological functioning mediate the effects of IPV on parenting. In a study of substance-using mothers (Brown et al., 2021), greater violence exposure and PTSD were associated with lower parenting competence. Furthermore, affected mothers may be less able to appropriately utilize, perceive, and create social support for their children. In a study comparing mothers living in the community and those in battered women's shelters, Jaffe et al. (2012) found that IPV-exposed mothers reported higher levels of permissive parenting than their counterparts who were not exposed to IPV. These authors also documented that mothers living in shelters reported higher levels of authoritative parenting than IPV-exposed community mothers and battered community mothers. Parenting behaviors were related to child outcomes; specifically, authoritative parenting promoted positive child outcomes in the context of IPV.

Finally, a strong relation has been found between IPV exposure and the most adverse form of parenting, child maltreatment. For example, Casanueva et al. (2014) documented in a national study of child welfare-involved families that approximately a quarter of mothers had experienced at least one incident of physical IPV in the past year. Further, using this same data set, Hazan et al. (2004) documented that mothers who had experienced IPV were more likely to have a history of child maltreatment than those without an IPV experience. In regard to parenting practices, associations between IPV and the use of psychologically aggressive, physically aggressive, and neglectful disciplinary practices have been documented among child welfare-involved families (Ogbannaya et al., 2019).

Despite this evidence, there is still ambiguity in the empirical literature relevant to the relation between IPV and parenting. Some studies have documented that victims of IPV may attempt to compensate for their children's exposure to family violence through more positive parenting practices. For example, in a large study of young children, Letourneau et al. (2007) documented a higher increase in positive discipline for IPV victims than for mothers not exposed to IPV. Similarly, studies have shown that IPV victims are not necessarily aggressive toward their children nor are they more likely to employ authoritarian parenting styles. Further, in a study of Latina parents, Jones Harden et al. (2021) did not find a direct relation between IPV exposure and parenting but found that parenting stress moderated the relation between IPV exposure and observed parenting behavior (i.e., elevated parenting stress was related to more harsh-intrusive parenting behaviors among IPV exposed mothers).

Child Maltreatment Perhaps the most adverse type of complex trauma occurs when the child is a direct victim, as in child maltreatment. Maltreatment is a severe form of adverse parenting that varies based on type, severity, chronicity, characteristics, and context. In the main, research shows that maltreated children are exposed to lower quality parenting when compared to their

counterparts who are not maltreated (Azar, 2002; Koenig et al., 2000). Parents who maltreat their children display decreased knowledge about child development and parenting (Azar, 2002) and, as a result, do not have appropriate developmental expectations about what their children are able to do. Maltreating parents also have lower quality interactions with their children and respond inconsistently to them (Azar, 2002; Howes et al., 2000). Their discipline is also harsher, and they tend to use corporal punishment rather than verbal discipline (Koenig et al., 2000).

As stated previously, much of the knowledge about parenting in the context of maltreatment is grounded in attachment theory. The clinical literature attests that children who are maltreated are deprived of the sensitive and responsive parenting that facilitates their secure attachment to their caregivers. Thus, maltreating parents engage in behaviors that are frightening for their children, which ultimately leads to negative developmental outcomes. Further, attachment theory suggests that maltreated children have negative "internal working models" (i.e., "ghosts in the nursery"; Fraiberg et al., 2018), which reflect their mental representation of their early caregiving experiences. These negative caregiving models affect their functioning as children and adults, including the quality of their parenting of their children.

Research has documented that maltreating parents exhibit lower levels of attachment-promoting behaviors, such as warmth, responsiveness, and sensitivity (Gao et al., 2017). Such behaviors may result in their children's disorganized attachment, which is associated with adverse child outcomes. Regarding "internal working models," some studies have documented that parents who were maltreated as children had a higher likelihood of anxious and avoidant attachment and dismissive and unresolved attachment states of mind, which were related to parental insensitivity.

Substantial research on parenting in the context of maltreatment emanates from Social Information Processing (SIP) theory. According to this theory, maltreating parents display specific social-cognitive deficits that affect their parenting (Azar, 2002; Azar et al., 2017). For example, there is research that documents maltreating parents' unrealistic expectations of their children, decreased skills in executive functioning (Azar et al., 2017), and lowered capacity for discussing past experiences with their children (Speidel et al., 2019). Multiple studies suggest that maltreated parents have more hostile, blaming, and unstable attributions toward their children (Pidgeon & Sanders, 2009). Mothers at risk for maltreatment have been found to have more difficulty identifying their children's emotional facial expressions (Shimada et al., 2019). Finally, lower levels of empathy and decreased capacity to take the perspective of others have been documented among maltreated parents (Rodriguez & Richardson, 2007).

Some studies have examined parenting processes based on maltreatment type. For example, emotional abuse or psychological maltreatment is characterized by harsh, insensitive, and ineffective forms of parenting that ignore children's basic needs (Wolfe & McIsaac, 2011). Emotionally abusive parents have been documented to use excessive criticism, verbal harassment, and inappropriate disciplinary techniques (Glaser, 2002). They also do not provide the affection and stimulation that children need and are more likely to expose their children to intimate partner violence and other forms of trauma (Wolfe & McIsaac, 2011). Emotionally, maltreated parents have also been found to have increased negative affect, depression, verbal aggression, and anger, as well as decreased emotional control/regulation and coping strategies (Lavi et al., 2015; Smith et al., 2014).

Child physical abuse has been associated with parent–child interaction behaviors that are characterized by negative affect (Wilson et al., 2008), as well as parent anger and hyper-reactivity (Stith et al., 2009). Berkout and Kolko (2016) found that parenting stress was related to higher negative affect, which was associated with child-directed aggression and less positive parenting. The literature on parenting in the context of sexual abuse mostly examines non-offending parents. Some research suggests that the support and

nurturance that parents provide their children can protect them somewhat against the psychological effects of abuse (Wamser-Nanney et al., 2020). Other research suggests that non-offending parents may experience elevated psychological stress due to the abuse of their children, which may lead to less positive, less consistent, and less involved parenting. They may also perceive themselves as having decreased parenting efficacy. Additionally, families affected by sexual abuse demonstrated challenges regulating anger, more chaos and less role clarity, and less reliance on adaptive-flexible relationship strategies than families without a history of sexual abuse (Howes et al., 2000).

There is substantial evidence base on parenting processes in the context of child neglect. For example, in a meta-analysis of parent–child interaction studies, Wilson et al. (2008) documented less involvement with their children on the part of neglectful parents. Parents who neglect their children have also been found to display lower levels of parental warmth and empathy toward their children, as well as harsher parenting, such as elevated use of corporal punishment (. Neglectful parents have been found to exhibit less proficient caregiving skills, less motivation around parenting, and less knowledge about child development than their counterparts who do not neglect their children (Stith et al., 2009). They are also more likely to perceive their children as problems (Stith et al., 2009).

Intergenerational Effects of Trauma and Parenting Beyond contemporaneous trauma exposure, it is important to recognize the intergenerational effects of trauma on parent and child outcomes. Trauma that exists across generations is transmitted through parenting practices and the experiences of the offspring of traumatized adults. For example, Cho et al. (2021) found that children of trauma-exposed parents have a higher risk of trauma exposure and that child psychopathology may emerge in these family contexts even if the children are not exposed to trauma themselves. Further, Cohen et al. (2008) documented the cumulative impact of maternal trauma on negative parenting behaviors, decreased parenting satisfaction, increased reports of child neglect, elevated use of physical punishment, and a history of protective services reports.

Parental trauma exposure often impacts children through problematic parent–child interactions. In a study on sex-trafficked mothers, it was found that they may have an overcontrolling relationship with their children due to their concern for their children's safety and inability to trust the world because their prior exploitation was usually caused by someone they trusted (Castaner et al., 2021). Cho et al. (2021) also argue that parents who have been trauma-exposed are more prone to have depressive and anxiety disorders, which can negatively impact parent–child interactions.

Further, building on attachment theory, Iyengar et al. (2019) posited that mothers' unresolved trauma was linked to their children's insecure attachment through mothers' lack of sensitivity to their children's needs and lower levels of involvement. Research on war-affected populations (e.g., victims of Rwandan genocide) has addressed this issue as well. For example, Jensen et al. (2021) found that caregiver trauma exposure was related to maternal mental health (i.e., emotional regulation, internalizing, and PTSD symptoms) and ultimately to parenting (i.e., more rejection and less acceptance of children). Similarly, Mutuyimana et al. (2019) documented a relation between levels of PTSD in parents and children, which the authors attributed to issues related to parent–child attachment and bonding, parenting styles, and parents' unresolved traumatic memories. Parents who have experienced significant trauma often demonstrate increased stress, decreased social support, depression, and partner conflict due to the demands of parenting (Lange et al., 2019). However, Lange et al. found that parents' report of Adverse Childhood Experiences (ACES) was related to their overall stress in the parenting role but was not related to their parenting behavior. Thus, the evidence is inconclusive regarding the intergenerational impact of more generalized trauma on parenting. However, the research on the intergenerational transmission of complex trauma (e.g., maltreatment), and its role regarding parenting, is clear.

The intergenerational transmission of maltreatment has received considerable empirical attention and validation (Rodriguez et al., 2018). In a recent meta-analysis, Madigan et al. (2019) documented a significant relation between parental history of maltreatment and their risk of maltreating their own children. It should be underscored, however, that although this relation has been found, all parents who were maltreated as children do not become maltreating parents, potentially due to the internal and external resources they had as children and adults (Casanueva et al., 2014). Beyond the intergenerational transmission of maltreatment per se, there is some research that examines other parenting processes among parents who were maltreated as children. In a meta-analysis of studies in this arena, Savage et al. (2019) documented a strong relation between parents' maltreatment history and their display of negative parenting behaviors (e.g., insensitivity, harshness, and corporal punishment) and compromised relational behaviors (e.g., attachment, bonding, mother–child interaction, and relationship). Finally, Valentino et al. (2012) documented that the risk for intergenerational transmission of child abuse was higher among mothers with a history of child abuse, elevated levels of community violence exposure, and decreased authoritarian parenting attitudes. Notably, in this study, authoritarian parenting attitudes were protective against intergenerational transmission of abuse for African American families.

Implications for Practice

Extant evidence underscores the pivotal role of parenting in the experiences and outcomes of children exposed to trauma. Evidence-based treatments designed to explicitly address the needs of trauma-affected children highlight the importance of a parent component. For example, trauma-focused cognitive-behavior therapy for children extends beyond the individualized treatment of child trauma to include intervention to improve parent functioning (e.g., trauma-related stress), parent facilitation of the child's processing of trauma, and other positive parenting practices.

Thus, there is a critical need for interventions that promote parent well-being and parenting skills in programs that serve trauma-affected children. Such interventions should be developmentally sensitive as parenting evolves over the course of children's developmental trajectories (Wulczyn et al., 2007). The interventions should also be culturally grounded to ensure that they are effective with distinct cultural groups and that they capitalize on protective factors in specific cultures (Self-Brown et al., 2011). They should also be linked to family engagement and referral services that address the socioeconomic and racial disparities that reduce access to these important interventions and the overall well-being of children and families from impoverished and minoritized backgrounds (Jones Harden & Slopen, 2022).

Finally, a public health framework (Herrenkohl et al., 2016) should be utilized to ensure that the children exposed to trauma have the opportunity to receive a continuum of interventions to prevent and treat child trauma exposure. Specifically, this framework argues for a three-tiered approach to parenting programs to address child trauma. First, universal/primary preventive programs would focus on all parents, whether their children have or have not experienced trauma, with the goal of preventing children's trauma exposure. Selected/secondary preventive programs would target parents with specific risk factors (e.g., parent mental health challenges, compromised parenting, and community violence), with interventions designed to reduce the risks for child trauma exposure. Finally, indicated/tertiary preventive programs would address the needs of families already affected by trauma, delivering parenting interventions that would decrease the likelihood of repeated child trauma exposure and of adverse child outcomes of the trauma. Programs in this last category could be oriented toward prevention or treatment.

With these principles in mind, communities and service settings could capitalize on the wealth of evidence about effective parenting programs in general and those explicitly addressing child

trauma exposure. As Prinz (2016) asserts, these evidence-based programs share many of the same characteristics, such as being (1) theoretically driven, (2) action-focused, and (3) oriented toward problem-solving. Prinz also argues that these programs should focus on (a) enhancing specific, concrete parenting strategies; (b) engaging in collaborative goal setting between the parent and provider; and (c) adopting a positive, strength-based frame. Although most trauma-focused parenting interventions are designed to address child exposure to complex trauma (i.e., Intimate Partner Violence and child maltreatment), some could be utilized with children who have experienced other forms of acute and chronic trauma. Notably, there is a paucity of evidence regarding parenting interventions for children exposed to community violence.

To address child trauma, Hobfoll et al. (2008) argue that prevention and intervention efforts should incorporate strategies that facilitate children's sense of safety, calm, self-efficacy, connectedness, and hope. Consistent with this approach, Gewirtz et al. (2008) proposed a Prevention Framework targeting five effective positive parenting practices that promote healthy child development: skill encouragement, limit setting, monitoring, interpersonal problem-solving, and positive involvement. The overarching goals of parenting-based interventions in the context of trauma exposure would be to facilitate parents' provision of a social environment with structure, security, and emotional warmth; and a social environment that addresses the traumatic event (Gewirtz et al., 2008).

Multiple studies have addressed providing Psychological First Aid (PFA) to parents and families following a disaster. For example, El-Khani et al. (2016) documented the feasibility of delivering PFA psychoeducation about parenting during crises to children and families involved in the Syrian war. In a qualitative study, Schafer et al. (2016) found that parents had reduced stress and increased self-efficacy following PFA training to parents on how to best support their children during war exposure in Gaza. In another qualitative study, Gilbert et al. (2021) documented that parents felt helped by this "whole family" PFA approach.

To address the loss and grief that emanate from experiences of trauma (Osofsky, et al. 2020), Sandler et al. (2013) established the Family Bereavement Program (FBP). FBP attempts to improve parental demoralization, increase parental warmth, address negative life events, and promote stable positive events in the family. In a study examining the impact of FBP, Hagan et al. (2012) documented that intervention parents showed increased warmth and more consistent discipline.

As mentioned previously, the majority of parenting interventions focus on complex, or interpersonal, trauma. Lindstrom Johnson et al. (2018) conducted a meta-analysis that examined intervention impacts on positive and negative parenting practices in the context of school-aged children's and adolescents' exposure to IPV and maltreatment. They documented moderate to large intervention effects for positive parenting practices, such as parental support and positive reinforcement of child behavior. They also found that interventions for IPV showed more robust effects in the area of parenting than programs for maltreatment.

Although most intervention studies for IPV address relationships among and the mental health functioning of adults, there is a growing literature on interventions to improve mothers' parenting behaviors. Austin et al. (2019) conducted a systematic review of parenting interventions in the context of IPV, documenting considerable variability in these interventions and limitations in study rigor. Project Support, a home-based intervention to reduce child conduct problems in the context of IPV, was one of the interventions with positive parenting outcomes. When compared to nonintervention mothers, intervention mothers demonstrated decreased inconsistency, physical and psychological aggression, negative affect, and harsh behavior (Jouriles et al., 2009).

Another intervention that has been evaluated for IPV-affected families is the Moms' Empowerment Program, which focuses on

increasing mothers' support, coping skills, mental health, and parenting knowledge and communication (Graham-Bermann & Miller-Graff, 2015; Howell et al., 2015). Regarding parenting effects, intervention mothers showed an increase in positive parenting and a decrease in negative parenting when compared to their nonintervention counterparts. Katz et al. (2020) documented parenting improvements in mothers with a history of IPV after their receipt of an emotion-coaching parenting intervention, including increases in emotion awareness and coaching, use of validation, and parenting competence, as well as reductions in the use of sermonizing, lecturing, and scolding with their children. Finally, child–parent psychotherapy (CPP) is a relationship-based treatment designed for young children and their caregivers who were exposed to trauma, in particular IPV (see Chap. 19, this volume). Evaluations of CPP have revealed improvements in child and maternal mental health, as well as parenting behavior (Ghosh Ippen et al., 2011). In a perinatal adaptation of CPP, Lavi et al. (2015) documented increased positive parenting practices in the intervention group.

A plethora of research has documented the impact of parenting programs on reducing behaviors relevant to child maltreatment. In a meta-analysis by Chen and Chan (2016), parenting programs were found to lower substantiated (i.e., via child welfare staff assessment) and self-reported maltreatment. Notably, effective parenting programs were found across levels of prevention including primary, secondary, and tertiary prevention programs. The authors also examined parenting processes as risk and protective factors for maltreatment. They documented decreases in ineffective parenting, parental stress, and inappropriate parenting (via self-report on attitudes and observed negative parenting behaviors) because of parenting programs. Regarding protective factors, this meta-analysis revealed that parenting programs led to enhanced positive parenting attitudes, parent–child interaction, positive parenting behaviors, and parental confidence and satisfaction.

Jones Harden et al. (2021, 2022) have highlighted the effectiveness of specific programmatic approaches for preventing maltreatment. For example, there is substantial evidence that comprehensive home visiting programs and theoretically based parenting interventions (e.g., attachment, cognitive-behavioral) can mitigate maltreatment and enhance parenting.

Comprehensive home-visiting programs address a range of family needs but tend to prioritize the enhancement of parenting. The programs are variable in prevention level (i.e., primary, secondary, and tertiary) (Herrenkohl et al., 2016), duration (i.e., 2 months to 5 years), and format (e.g., curriculum-based and interaction-based). Home-visiting programs have been documented to reduce the risk of maltreatment by improving participants' parenting skills, such as reductions in physical punishment and aggression toward children (Avellar & Supplee, 2013). While some of these home-visiting programs are explicitly designed to reduce child maltreatment (e.g., Healthy Families America, Lee et al., 2018; Family Connections, DePanfilis & Dubowitz, 2005), others target goals situated in the maternal-child health arena (Nurse Family Partnership, Donelan-McCall et al., 2017; Family Connects, Dodge et al., 2014).

Attachment theory has guided the development of multiple effective parenting programs (Berlin et al., 2021). These programs are designed to enhance the parent–child relationship and interaction by using experiential strategies such as coaching and video-feedback to achieve this goal. They typically focus on young children and families, are brief (2–12 months), have limited objectives, and are intensive (e.g., focused on behaviors, high level of involvement of the interventionist, in the secondary or tertiary level of prevention). Programs in this arena have been found to reduce the risk of maltreatment as well as improve parenting behaviors, such as sensitivity and responsiveness. Examples of such interventions are attachment and biobehavioral catch-up (Dozier & Barnard, 2019), promoting first relationships (Kelly et al., 2008), child–parent psychotherapy (CPP; Lieberman et al., 2006), and child first (Lowell et al., 2011).

Similarly, parenting programs found to be effective in addressing maltreatment are grounded in social-cognitive theory. They tend to focus on behavior change (i.e., improving parent management skills to reduce behavior problems) or relationship building (facilitating emotional regulation, communication with children, and more appropriate cognitions and behaviors with respect to children) (Dretzke et al., 2005). Social-cognitive programs typically target a broad age range of children and their families, are brief (2–14 sessions), and are intensive (in the secondary or tertiary prevention arena). They have been found to be effective in modifying many parenting behaviors, including reducing child abuse and physical punishment, as well as promoting emotion regulation and appropriate discipline (e.g., use of praise and incentives).

Exemplars of evidence-based programs in this arena are cognitively enhanced home visitation for parents at risk of abuse (Bugental et al., 2010); Parent–Child Interaction Therapy focusing on parenting management (Batzer et al., 2018); Incredible Years group-based intervention (Webster-Stratton & Reid, 2010); Family Check-up, a brief intervention that connects low-income families to parenting interventions (Dishion et al., 2015); SafeCare (Guastaferro et al., 2012), an in-home parenting program that focuses on positive parent–child interaction, home safety, and child health; and Positive Parenting Program (Prinz et al., 2009, 2016), a multilevel, multi-pronged, population-based program to reduce child maltreatment.

Although parenting programs have been found to be effective in reducing the sequelae of trauma exposure for adults and children in families, they should be implemented in the context of a trauma-informed, early childhood system of care (Dodge et al., 2014). Coordinated trauma-informed systems of care are needed to address the significant public health issue of early life stress and trauma https://www.apa.org/monitor/nov02/curbsma. A trauma-informed system not only recognizes the effects of trauma on children and families but also works to establish policies and procedures that do not inadvertently retraumatize children at the same time as efforts are instituted to keep children safe (Ko et al., 2008).

Summary and Key Points

In this chapter, we reviewed studies of parenting in the context of trauma, primarily emanating from violence. The evidence suggests that parent and child trauma exposure, whether acute, chronic, or complex, affects the parenting that young children experience. Although most of the evidence suggests that trauma negatively affects parenting, there is some research that suggests that parents may exhibit positive parenting in the context of trauma to protect their children against the vestiges of trauma.

Clearly, the impact of trauma on young children is greatly influenced by the caregiving that they experience. Consistent with the general parenting data on young children, caregivers' level of functioning and the related care of their children are critical for the outcomes for children exposed to trauma. For example, there is an abundance of research that suggests that sensitive and responsive caregiving can attenuate the effects of trauma on young children's functioning. In contrast, compromised parenting (e.g., punitive, detached, and maltreating) can intensify the adverse effects of trauma on children's outcomes.

The preponderance of evidence from both clinical observations and available empirical literature indicates the crucial need for caregiver support in families that have been exposed to trauma and experienced violence. Future empirical studies would be helpful in delineating the processes through which parenting can attenuate the effects of trauma on children. Further, it is important to learn more about the effectiveness of supportive preventive intervention and treatments, as well as the relationships between supporting parent mental health in order to both protect and enhance functioning in traumatized children.

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27

Rethinking Early Childhood Trauma as a Dynamic Developmental Process in Making Meaning, Emerging from Chronic, Repeated Experiences and Reiterated Mental Processes

Ed Tronick and Richard G. Hunter

We aim to provide an alternative view or perhaps a complementary view to the idea of trauma seen as an acute severe event and a major cause of psychopathology. More specifically, we do not see trauma as *the* mechanism driving dysfunction or psychopathology. Rather, as developmental neuroscientists, we see development and the quality of lifelong functioning emerging from chronic, repeated experiences and processes, primarily external interpersonal relational experiences and internal mental processes, mechanistically carried out by somatic and neural—neurosomatic—processes. Framing our view of development in this way, we adhere to a biological view of humans (or any organism) as a dynamic open system that must apprehend (appropriate) environmental resources—energy and information—on a continuous basis. The extent to which the child is successful or unsuccessful in acquiring these resources over time, at what rate, and in what form sculpts their neurosomatic systems, experience, and ways of being, for good or ill (Tronick & Hunter, 2020; Tronick, 1998; Sander, 1977; Harrison, 2003).

Additionally, the lack of a developmental perspective, along with the dominant psychopathological perspective framing our thinking about trauma, silos our understanding of trauma, the value of trauma theory, and trauma-informed practices. The perspective also limits our inquiry into other features—healthy or problematic—of the child's functioning. Indeed, we object to the view that a traumatic event – the event we note in our language, diagnoses, and reports (e.g., sexual abuse at age 9)—is the *only* dangerous outcropping in a (psychic) landscape as if it was the only dangerous feature of an otherwise-pastoral (homeostatic) landscape. From our perspective, the outcropping is only a larger, easily identified feature of a grim rugged landscape of more-subtle and hard-to-identify discordant, dangerous, and toxic features. Rather, picture an environment with one large slippery outcropping, otherwise covered with ruts, rocks, slick mud tracks, fallen trees, and large and small obstacles. Furthermore, typical of landscapes experiencing climatic stress, it is a dynamic and constantly changing landscape. Even if there were only one outcropping, its contours would weather and change.

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Are Events Inescapably Traumatic?

Critically, although most clinicians and diagnostic manuals see the outcropping as having a fixed meaning and a determinant effect, we see a child who is experiencing the event as making a unique meaning of it. For example, we need to recognize that the meaning made by one child of an event may be radically different from the meaning made by another child. The game of infants being tossed high in the air by a parent, caught, and tossed again leads to joyous excitement for some and terror for others. The experience is different from one child to another. The meaning made is individualized. A child may experience being fondled as pleasurable, while another child experiences it as intrusive. These individual differences may be related to temperament or the operating characteristics of a child's neurosomatic systems, such as a system threshold of reactivity, its upper and lower thresholds, and the form of its reactivity. For example, an infant with a low threshold for the reactivity of the amygdala may find an event fear inducing, whereas an infant with a higher threshold may hardly react at all. In essence, the observed reaction is related to the event and mediated by organismic neurosomatic processes (Porges, 2011).

Furthermore, in addition to individual differences, there are also developmental changes. Think only of the stages of Piaget's (1954, 1971) theory of development or any other theory, including neurobiolgical theories (Teicher et al., 2016; Wiesel & Hubel, 1963; Gunnar et al., 2015; Packard et al., 2021; Eslinger et al., 1992), that view development as involving qualitative changes. The infant to Piaget makes meaning by using sensorimotor processes and a few years later by using concrete operations. Stechler (Stechler & Latz, 1966) additionally said that meaning was sensory affective in infancy, as well as in later development. Though hard for an adult to imagine, for Stechler, the meaning of an object or event could be joyous, scary, pleasurable, or another affective reaction. Importantly, with development, new systems of meaning making emerge, such as language and symbolic thought. But language does not overcome the problem of the complexity of meaning. As Madison wrote in *The Federalist Papers No. 37* when commenting on originalism (fixed meaning) in the United States' constitution, no language is "so correct as not to include many equivocally denoting different ideas," and their meaning can be obtained only from interpersonal engagement with the words. Indeed, in the context of therapeutic work, the clinician, in collaboration with the patient, has to explore the meaning of words to the patient. Furthermore, with the development of meaning-making systems, the meaning and recall of earlier events changes. That is, when new language and cognitive capacities emerge, the memory-recalled events change and change the current experience of what had occurred.

Certainly, neurobiological theories focusing on brain development emphasize the radical changes in the structure and function of neurological architecture and processes. Developmental cognitive neuroscience tells us that while most children won't be able to reliably form autobiographical memory until they are roughly 4 years old, infants are capable of conditioning, as are fetuses in the latter stages of fetal development, a process that influences their predictions about the extrauterine world. Perry (2008, 2009) characterized the malleability of regulatory processes early in development and their changes with maturation and experience. These changes or the operational forms taken on by the regulatory process modify other higher-order processes and the meaning made of events. All told, the intersection of individual differences, developmental changes, and actual experience engender a vast untold variety of dynamic changes in the meaning of events.

We therefore disagree with the argument, made by some clinicians and researchers and reified in some of our diagnostic manuals, that specific events are inescapably traumatic. Of course, some events are more likely to generate a traumatic-like experience, but still, the meaning made of it will be different for different children. Moreover, the meaning is not fixed. Once made, the meaning will continue to evolve in different ways for the different children even if the event is never experienced again. Although we recognize

that, in rare cases, an event, such as a once-in-a-lifetime slap of a child or the inadvertent neglect of a child (e.g., leaving a child alone at home for too many hours), may actually happen only once, it is never experienced only once. Primary mental processes continue to operate on the meaning made and change it each time it is operated on and re-experienced. Again, the meaning is not fixed.

Stress – Acute and Chronic

The operation and interplay of these processes has long been observed in the field of stress neurobiology. Chronic stress exposure differs substantially from acute stress in their respective impacts on both physiology and behavior (McEwen et al., 2015). Most animals, ourselves included, are well adapted to handle acute fight-or-flight events, which helps explain both the high levels of resilience observed in the general population to single traumatic events. Such singular events may only weakly initiate internal repetitive mental processes, may have few triggers, and may have fewer dysfunctional regulatory effects because the child's caretakers/social partners provide ameliorative regulation and because the meaning made by the child makes the event benign. Thus, most of us will be exposed to a traumatic event in our lives, but only a minority will develop a lasting disorder like post-traumatic stress disorder (PTSD) as a consequence (Hunter et al., 2018).

In contrast, chronic stressors tend to produce lasting effects on our brains and bodies. These effects operate from the molecular epigenetic level to the systemic and behavioral. Epigenetic changes can have long-lasting effects on gene expression in a number of stress-sensitive brain regions, and these in turn likely contribute to persistent changes in cognitive flexibility, threat assessment, and reward systems, to name a few (Griffiths & Hunter, 2014; Bartlett et al., 2019). Chronic stress can also alter mitochondrial dynamics in the brain, both directly through the actions of stress hormone receptors and indirectly through alterations in the neuroendocrine axis (Picard et al., 2018; Hunter et al., 2016; Lapp et al., 2019). As mitochondria play vital roles in energy availability in the brain, changes in their function have immediate and lasting impacts on the affected brain regions. Chronically high levels of glucocorticoid stress hormones can also lead to persistently elevated levels of blood glucose, which can in turn contribute to decreased insulin sensitivity, metabolic syndrome, and type 2 diabetes (Seal & Turner, 2021). Similarly, glucocorticoids act acutely as immunosuppressants, and more chronically, they can cause a variety of immunological dysfunctions (Goldschen et al., 2023; Picard et al., 2014). The burden of chronic disease that results from high levels of childhood adversity likely results from a combination of these factors acting in concert (Felitti et al., 1998). The chronic, stabilized nature of traumatizing childhood environments is key to understanding their pernicious effects. In sum, attempting to conceptualize trauma as a universally discrete, acute event obscures these linkages and prevents us from seeing the powerfully biologically embedded nature of trauma.

Obviously, to some extent, our view raises questions about the use of the term *trauma*. However, for now, the term is with us, and it is sticky. While we are stuck using it, we argue for a more developmentally informed perspective. It is not having to climb the steep outcropping that results in the damage, but rather, having to walk the rutted, rugged landscape is damaging, and it in turn makes the climb more difficult. In other words, the damage—the trauma—emerges from the accretion of meaning continuously made by reiterated mental processes and repeated events.

Uncertainty, Prediction, Fear Conditioning, and Trauma as a "Game"

While the following is somewhat a simplification of the complexity of how a meaning is made of events, an alternate way to conceptualize how even a single act of abuse can take on a chronic character, one can look at events of abuse from the perspective of learning theory, specifically

fear conditioning. All learning is ultimately about prediction, and fear conditioning is an overdetermined process in that successful fear learning is necessary for survival. Predicting violent or abusive interactions has obvious survival value, not just in an abstract evolutionary sense but also in the very real world of the traumatized child (see the extensive work at the Center for the Developing Child). Therefore, most mammals can learn a fearful association with a single exposure. In the absence of extinction, these memories will cause the person to activate an autonomic fear response each time the conditioned stimulus (the abusive caregiver) appears. This sort of learning is also prone to generalization, such that particular aspects of the stimulus (for example, a specific odor, like a cologne) can also provoke a response. The implication is that even one frightening interaction with a parent or caregiver can make every future interaction a fearful one. Of course, if an act of abuse is truly singular, one pathway is that the fear memory may extinguish with time. However, in humans, even infants, extinguishing is unlikely. Rather, if the event is intense or if it is carried out by a person important to them (a parent), the experience/memory of the event is likely to be repeated by unconscious and conscious mental processes and be self-amplified by internal meaning-making processes. Moreover, if the event per se is repeated, which is also extremely likely, even if it is only at a very low frequency, the fear reaction becomes a persistent part of how the child makes sense of the world.

Let's employ a metaphor here. While becoming traumatized is hardly a game, the process of making meaning of a traumatic event and that of making meaning of a childhood game, such as peek-a-boo, are similar (Perry, 1999; Tronick, 2017). Learning peek-a-boo and becoming a skilled peek-a-boo-er take months and hundreds of repetitions, along with facilitating developmental changes. At the heart of the similarity is the likelihood that both events will be repeated multiple times. The exogenous and endogenous repetitions instantiate the game and, if you will, the trauma into the child's way of experiencing and being in the world.

Let's take the metaphor one additional step beyond repetition and context: We must consider the power of parental relations during development in shaping the meaning that the child makes of an event. We have already noted the particular significance to a child of an event carried out by a parent, be it a game or a slap. A critical influence on the meaning made by the child is how the parents relate to the child *after* the child experiences the potentially traumatizing event. We know from acute events, such as car crashes, that a child may have an acute reaction. However, chronic effects typically emerge when the parents experience ongoing anxiety about the event. Their anxiety colors and is embedded in their parenting and maintains and exacerbates the child's initial reaction. It is not necessarily the parents' referring to the event, which some do, but rather the ongoing anxiety that the parents are experiencing that distorts their parenting practices. The anxiety of their parenting is detected by the child and consequently triggers their own anxiety tied to the event.

For example, in our study of the maternal acute stress paradigm, we had all the mothers in the study playfully interact with their infants face to face (Mueller et al., 2021). Following that playful interaction, mothers were randomly assigned to either hearing infant cries and seeing photographs of distressed infants or hearing positive infant vocalizations and seeing photographs of smiling infants. Infants could neither see nor hear their mothers during the exposure. Following the exposure, the mothers and infants interacted again. We expected to see differences in the behavior of the mothers, where the mothers who heard the cries problematically interacted with their infants compared with the mothers who heard the positive vocalizations. Although we used several ways of evaluating mothers' behaviors with different coding systems, we did not see significant differences between the groups of mothers. Nonetheless, the infants whose mothers heard the cries reacted with negativity and distress during the interaction compared with the infants whose mothers heard the positive vocalizations. The finding speaks to the powerful, but perhaps cryptic, effect of stress on the mothers'

behavior for the adult coders. However, it was not cryptic to the infants whose reactions demonstrated their sensitivity to the effect of the stress on their mothers.

Finally, the focus of our clinical and research work is on infants and young children and their parents. Our perspective draws on work with children, including work on the still-face paradigm, the face-to-face interactions of parents and infants, the crosscultural studies on parenting, and the effects of maternal depression and anxiety on infants (Tronick, 2007). Though infants are obviously not adults, we think the work is quite relevant to adults because the regulatory processes and meaning-making systems established in infancy are still operating in adults. In particular, the focus is on ongoing processes, external events, and internal mental processes that organize experiences. We will not be proposing new techniques but instead hopefully a challenging evocative developmental framework emphasizing the quotidian engagements of a child with other individuals and with the inanimate world. As a consequence, we will challenge, but hardly dismiss, the notion of trauma as it relates to attachment or the idea of trauma-informed clinical work and intervention.

Meaning Making Is Neurosomatic and Never Just One and Done

Our thinking focuses on the formulation by Bruner (1990) that humans are makers of meaning. The term *makers* is critical. It emphasizes that humans actively engage in the process of making meaning. We see meaning making about one's self in relation to the world of people and things, as well as to one's own self, as a core organizing concept in therapeutic approaches; we see it being as varied and contentious as body psychotherapies, psychoanalysis, psychodynamics, CBT, dialectical cognitive therapies, dyadic therapies, attachment styles, relational therapies, and others (Tronick, 2007; Ogden & Fisher, 2014; Modell, 1993).

Meaning is central to the phenomenon of trauma. Typically, when discussing trauma, the focus is on the event (e.g., sexual abuse by a sibling; see the Zero to Three Diagnostic Manuel) or physiology and brain processes. Certainly, some events, such as a too-long time out or a spanking for a misdeed, are likely to be traumatic to some children but not to all. And there are events seen as likely to be mild and mundane that may be traumatic to some children, such as a parent's walking away from a distressed child, but not to others. Or think about whether a 4-year-old might experience genital fondling by an older sibling as sexual abuse or perhaps as playful and exciting. Indeed, what would a clinician think? Most likely, they would think that the fondling *is* a trauma. For us, it is the meaning made of the event by a child, its context, and its effects on the meaning of other events that must be explored and might lead to seeing the event as trauma or not. Also, how the meaning changes over time because of developmental changes is critical. The playful fondling experienced by the sibling at age four may become a trauma for the "victim" when they reach puberty or adolescence. Just as critical is how others in the child's life make meaning of the event, especially in how the meaning made by others of the event affects how the child relates to them. In this example, the sense of horror experienced by parents discovering what they decide is abuse by the older sibling and their deep and anxious concern for the 4-year-old, along with their punitive reaction to the sibling, will likely lead to changes in the playful meaning made of the event by the younger child.

Meanings are made continuously and simultaneously, in real time, and at multiple levels of somatic and neurologic systems—that is, through neurosomatic meaning-making systems. The loss of any of these meanings—the meaning about oneself to oneself or the relation of one's self to the world—results in serious psychological dysfunction and psychopathology. Modell (1993) argues that the failure to "make meaning" of one's private self is a psychic catastrophe, which is typically labeled as trauma. From a developmental perspective, however, more common than failures to make meaning are the meanings made about the mundane, quotidian events that distort one's sense of the world and sense of one's self.

The sneering, mocking look from a parent when a child somehow fails to fulfill the parent's unspecified desire can lead the child to make the meaning that they are defective and ineffective, and their experience of the world is then filled with contempt. The sneer is not a traumatic event per se, but the meaning that the child makes of it can become one as that child brings the meaning that they made of it into more and more of their daily exchanges with people and even things and events.

From the example, keep in mind that the process of the making meaning of the sneer is not just of the moment; it is *not* one and done. The experience is sticky. Neurosomatic meaning-making processes go on internally and operate continuously. They, like the Energizer Bunny, keep on going and going, affecting the meanings made as life moves on. Worse still, the initial meaning made goes on to affect the next meanings made. The later emerging meanings generate further distortions and increasingly insidious debilitations that indeed may be far more derailing than the initial meaning made of the first sneer. There is an elaborating and intensifying cascade of effects.

A Developmental Open-System Perspective

The continuous process of meaning making conforms to the larger framework of open systems (Tronick & Beeghly, 2011; Tronick, 2003). A first principle of open systems—all biological organisms—is that they must gain resources, energy, and information to maintain their organization, to grow, and to develop. Failing to gain energy leads to the dissipation of organization, aka death. A child consuming milk thrives, builds muscles, increases brain cell number, energizes growth-promoting bodily processes, explores the world, and garners information. A child consuming potato chips builds fat, diminishes brain cells, and activates short- and long-term debilitating bodily processes, such as diabetes. The need for nutrients for physical growth is obvious are necessary. So too do the child's mental development and growing understanding of their world, except the nutrients for growing mental capacity to make sense of the world are information. It is the information actively appropriated during the child's continuous engagement with the world. Meaning-making processes, then, operate on the information available, and in turn, they expand or constrict the child's sense of self in the world. Think only of the primate-sensory-deprivation studies or the specifically human-sensory-deprivation studies to understand how a poverty of information distorts and disrupts development (Wiesel & Hubel, 1963; McKinney, 1972). In regard to trauma, think about the effects of neglect, a form of depriving a child of social-emotional relational information. The damaging effects were powerfully and poignantly demonstrated in Harlow's work with socially deprived macaques (Harlow & Suomi, 1970) and the social deprivation of humans in orphanages (Spitz & Cobliner, 1965; in J. Robertson's film, a 2-year-old goes to the hospital, 1989; Bowlby, 1960).

A consequence of the first principle of open systems requires that a child *must* actively and continuously engage with the world in order to gain necessary resources because additional resources exist only externally. Indeed, the child requires gaining a positive balance of "excess" energy beyond that required to maintain their organization if they are going to develop, to qualitatively change, and to engage their endogenous meaning-making processes. For example, a child suffering starvation is motorically and mentally apathetic. They cannot maintain their organization or appropriate resources. The meaning they make is about the threat of the dissipation of their self, what Melanie Klein called annihilation (1929). By contrast, the active appropriation of resources allows the child to integrate the new meaning and the past meaning into their current and continuously evolving meanings (Tronick & Beeghly, 2011).

Keep in mind that meaning making is neurosomatic. In infants, meanings about the world, such as "this person is a scary stranger," are made without language and advanced cognitive processes, an immature brain, and still-developing regulatory systems. Or think of a 5-year-old

whose autonomic nervous system's set point for threat is low, such that small stressors lead to full-fledged fear reactions (Tronick & Beeghly, 2011). As a result, the unceasing ambient meaning of the world is one of danger and threat. And the lulls of fearfulness are likely short-lived because the process is ongoing and because the meaning lingers. The low threshold affects even the meaning of what would be benign events to other children.

A persistent bias toward threat detection in ambiguous stimuli can crowd out learning about important positive social cues or even internal cues. The phenomenon of alexithymia, or the inability to identify and articulate one's own emotions, is common in people who have been exposed to chronic childhood abuse and neglect. If one lives in a state of constant fear, one may not develop a capacity to fully experience other emotions, much as a kitten raised in darkness may never develop full vision.

A developmental open-system perspective holds that *all* current experience affects the meaning made by a child and, to the greatest extent possible, that the child should—must—have *agency* to determine their engagement with the world and with others on a moment-by-moment basis (Sander, 1977). Thus, the child can take hold of information to internally create new psychobiological meanings and ways of being in the world.

We also see the meanings about the world and the self as assembled into a neurosomatic state of consciousness (Tronick, 1998, 2003; Tronick & Beeghly, 2011). A state of consciousness, an integrated state of brain and embodied processes, holds the meanings that guide the child's engagement with the world. But it is not static. For example, descriptions of the still-face paradigm refer to its "signature" effect: the infant turns away, being distressed and fearful, yet the infant still feels effective—"I can get you back"—and keeps trying to elicit a response in their mother. But that state of consciousness changes over time with longer exposure to the still face. The infant stops trying to elicit a response in the mother, their posture collapses, and they enter a helpless state of consciousness: "I can't change what is happening." The meaning of the still face changes over the typical 2 or 3 min of exposure. An upshot of this is that the typical view of trauma, which sees trauma as static, where the meaning of a trauma is its original meaning when it was first experienced, is incorrect. More likely, a change in its meaning is brought about by its ongoing external and internal reiterations, which modify the meaning made of the experience over the course of daily living and ontogenetic development. Moreover, its meaning at any moment in time affects the meaning made of the next emerging meaning, as well as the meanings made of other events and of the self.

The Principles of Reiteration and Messiness

Although it is a bit of hyperbole, a typical view of the singularity and power of trauma is that it affects all experience and is the primary event leading to psychopathology. Though a view held by many, the idea that there is only one primary cause of psychopathology is farfetched. In contrast, a developmental perspective not only invokes multiple casual factors but also qualifies the "all" with the principle of reiteration: the *all of* an experience that affects the meanings made by the child are chronic, reiterated experiences (Perry, 2008; Tronick, 2007). We will come back to this "all," but what do we mean by the recurrence of experience?

The developmental view, as well as the plasticity view, of brain development of recurrence is that the experiences of events have their effects because of their reiterated occurrences and the child's repeatedly making neurosomatic meaning of them. In this view, an event that shapes a child's meaning about the world is like learning to play peek-a-boo. How does a child come to know the game of peek-a-boo (Bruner & Sherwood, 1976; Commons et al., 1998)?

The game of peek-a-boo is a dynamic interplay of actions and information between a child and an adult. The game is governed by rules but flexible in its enactment. Often, there are unique individual, familial, and cultural variations.

Despite our saying that a 4-month-old plays peek-a-boo, we recognize that a young infant does not actually play peek-a-boo. At first, they have no idea what is going on, though the game does have some indecipherable meaning for them. After all, they react to adults' actions with smiling, crying, looking away, or turning away. The game is played "at" an infant by an adult, who initially plays *all* the sides of the game. The infant makes a large number and variety of behaviors. They have lots of varying intentions and meanings about what is going on, many of which are unrelated to the adult's game-playing actions. The infant looks away when they "should" be looking toward, or they raise their shoe or look at their hand. What they are doing is messy—variable, unstable, disorganized. Yet with recurrence over time, the infant attends and begins to anticipate the coming "boo," and some of the messiness is repaired and pared away. With more recurrences and developmental advances, the infant begins to become agentic and to control some of the elements and the pace of the game. They come to signal the timing of the "boo," and their reactions become more coherent and contingent. As the game is acquired, the infant begins to learn pieces of how to be the "surprisee" and then the "peek-a-boo-er." Sequences and rhythms emerge.

While all that is going on for the infant, the adult continuously makes adjustments (e.g., holding positions longer) in relation to the infant's actions and intent. Bruner calls these adjustments scaffolding (Bruner, 1990). Such scaffolding is intuitive and implicit. The selective assembling of the infant's self-organized actions and intentions, *and* their apprehension of the adult's actions and intentions, *and* the adult's reciprocal apprehension become incrementally more coherent. Their mismatches get repaired. And through endless repetitions, the game continues until it is entirely "within" the child and, at the same time, fully within the child–adult dyad.

Simply put, coming to know peek-a-boo is a messy process that is slowly cocreated over repetitions through repairs of the messiness. Moreover, its meaning for the child changes from (perhaps) something exciting and fun to something played with the carer, to a game played with others, and, finally, to a boring game: "I don't want to play anymore." And none of this knowing is explicit until the second year, but before that, it is embodied in multiple neurosomatic systems.

At this point, we make a few points about the process of acquiring the game. Fundamentally, it must be played in a relationship. Acquiring a game depends on the infant's being in interaction, in a relationship with a person who not only knows the game but also is willing to "teach" the game to the infant (Bruner, 1990; Vygotsky, 1978). Infants cannot teach the game to themselves. At any age, the learning of the game depends on the repetition of the game and the development of different capacities at multiple levels (neurologic, regulatory, motor, emotional, and cognitive) that make the acquisition of a game possible. A 3-month-old does not have the capacities to learn the game, no matter how often its recurrence. The game is also individualized. The adult who is playing it with the infant plays the game in a unique way, and the infant acquires that unique way. Better said, they cocreate a unique way of playing the game together. In an important sense, they cocreate a unique game of their own (Tronick, 2017). Like all children's games, the game is arbitrary, in the sense that it has a history in a cultural context. It is not built in via evolution. It is a canonical cultural artifact, played in the way it is played in a particular culture (Bruner, 1990). Other cultures play other games in their own cultural forms, though they are acquired in reiterated relational contexts.

In learning theory, these games are about prediction. One of the better-established models of classical conditioning is the Rescorla–Wagner model (Rescorla & Wagner, 1972). This model posits that conditioning is built on accurate prediction via error correction (repairs) each time a particular contingency is presented. In the case of peek-a-boo, the error factor is initially near 100% because the infant has no way to grasp what is going on or even whether their caregiver will reappear. As the game is presented over and over, the prediction error for the infant declines to zero and perhaps becomes uninteresting, because more-complex games become possible as

learning capacities develop. Of course, getting these predictions right becomes even more pressing when the situation ceases to be a game and is more threatening.

More generally and importantly, we see the acquisition of a game by an infant as no different than the infant's coming to know any other cultural form of behavior or any form of procedural knowing that involves spontaneous ("natural") interaction—that is, their way of being with others and acting in the world. The infant comes to know the "game" of cuddling, the "game" of feeding, and the "game" of greeting a stranger. Infants develop the "game" of being demanding, the "game" of taking a bath, and the "games" of changing, nursing, and going to sleep. Each of these "games" recurs dozens, even hundreds, of times a month. Each has a form that is individualized and culturated ("culturated" is a neologism meaning fully, inherently, and inescapably imbued with culture, a phenomenon that developmentalists are only beginning to gain traction on). Each is dynamic and changes with experience and the development of new capacities. The process of acquisition is messy and requires repairs. And each involves repeatedly experiencing the "game" with another person to finally get it into the infant's state of consciousness. The form that it takes in the infant reflects the form of the "game" in the adult's state of consciousness because that form guides how the adult plays the game. In the end, the infant who comes to know the particular form of the "game" of being the victim of abuse also eventually comes to know how to be an abuser.

The "Game" of Being Slapped

We hope that this account of the normal developmental process of learning "games"—actually learning ways of being in the world—is starting to have some linkage to our understanding of trauma. Let us make the linkage of this kind of developmental process to the child's coming to know the "game" of being slapped. Again, being slapped is not a game. In contrast, peek-a-boo is a game but is also far away from trauma, but for our purposes, it is not. Getting slapped is an exemplar of thinking about the trauma associated with any event, including the interplay of multiple factors.

To begin, the physicality of slaps is not consistent (Tronick & Perry, 2014). Slaps vary in intensity, and their targets vary. Here, think about a slap to the face of moderate intensity. The first slap a child receives is not experienced the same way as the tenth; it is unique. It changes the child's state of consciousness about the world and their meaning making. But so does the tenth slap, as it must because the child has made meaning of the nine preceding slaps, and the meaning of the tenth has to be integrated with the meaning of those that came before it. By the tenth slap, the child's prediction error is less than a tenth than it was for the first, and the association between the slapper and the slap is much more firmly and lastingly established. Another way to speak of prediction error is to think of it as uncertainty, and the uncertainty of an event adds stress to an event. The first slap is an uncertain, unexpected event, but the tenth slap further confirms the certainty of its happening and perhaps has less force. The child knows what is coming.

Moreover, the slaps are not the same, depending on the motivational state of the child. Its meaning when the child is slapped when concentrating on a game and feeling safe is different from when they are slapped while hiding and in a fearful state or in an angry state. Moreover, in the next moment after the slap and then for succeeding moments, the child's state will change, and with it, the meaning of the slap will change. Perhaps the metaphor is gratuitous, but the first slap is like the big bang, a process that changes "everything" in the very next moment and then more slowly in each succeeding moment.

Critically, with mental and physical development, the "same" physical slap is experienced differently at 2 years of age, at 5 years, and at 10 years. It is also different if it was last experienced at 2 years or 5 years or the week before, and a slap is different if it was never experienced before. Furthermore, whatever agentic actions the child takes—fighting back, running away, freezing, or else—will change the nature of the

experience of the slap. Just imagine the difference of experience between a 3-year-old kicking the slapper or alternatively running away and hiding behind a couch. To further complicate the picture, the context matters. Was the child in and around the slapper much of the time? Was the slapper a stranger? Was the slapper a parent, a carer, or a babysitter? In a word, the details, even microdetails of the event, matter in determining the event's meaning and effects.

Yet there is more. First, suppose the slapper is someone who regularly cares for the child. In that case, we know that the slapper's nonslapping caretaking is at the very least problematic, even if it does not continuously derail the child. Slappers don't parent well; they are angry and threatening, demanding, neglectful, falsely apologetic, or whatever. How the slapper behaves, what they do or don't do, and what their intentions are or mood is affect the child's experience of a slap. A slap in anger is not the same as an apologetic slap (whatever that might be). Thus, it is critical to recognize that the child is already under continuous pressure from the slapper's *non*slapping distorted caretaking. The experience of the slapper's nonslapping problematic caretaking fills the time in between the slaps and exacerbates the effects of a slap when a slap occurs. Even a single slap in the context of disturbed parenting could be enough to disrupt the child's development. Moreover, when we say a particular event is traumatic—a slap—our view is that it might not have had so debilitating an effect except for the already-vulnerable state of the child given the in-between disturbed nonslapping caretaking that they have received. So, we ask, is a slap, a fast physical event taking only milliseconds, really an acute singularity?

And still there is more. The factors in play are multiple and complicated. It is not only the occurrence of the slap or the disturbed parenting that will derail the child. We all know about the triggers of trauma that are present all around the child all the time that reignite the experience. They are often unavoidable, everywhere. However, the current emphasis on banning triggers is almost a parody: ban specific words, canonical pictures, or plays and movies as if they were universal fuses illuminating a dark hidden event. But triggers are unique to the child and unique to the original experience. The spilled and broken coffee cup, the crushed beer can, the flowers in the room where the beating took place, and the stuffed toy the child was holding can be triggers.

Critically, aside from external triggers, the child will trigger themselves. Saying that is not blaming the child; it is blaming how evolution has organized the way that humans make meaning. The child will make meaning of the slap and caretaking, and she will keep on processing it. It is not one and done. She will re-experience its vagal and hypothalamic pituitary adrenal (HPA) axis effects, repeatedly memorialize it, and perseverate on it, re-examining what happened and what she did. She will lock in associations to it, the triggers we wish we could banish. Most insidiously, she will anticipate its happening again. The self-generated mental reprocessing occurrence of it and the self-generation of triggers will go on and on with continuous, never-ending meaning-making processes changing the meaning and fueling and self-amplifying them. Even more insidiously, she may make a self-conception that she is someone who should be slapped, a destructive meaning that will have profound consequences on her expectations of and interactions with the world in the future: "The world will always slap me. It will happen. No need to worry about it."

These self-generated meaning-making processes with an older child or adult may be explicit and carried out in their awareness as well as in the body (Van der Kolk, 1994). In an infant or younger immature child, they will be neurosomatic, the embodied processes that make meaning completely outside of awareness and without language. For example, a lower activation threshold and a slow recovery pattern of the HPA axis will generate the experience of the fear of unexpected events that in turn lead to more internal fear and anxiety. We often see these embodied forms of trauma in our patients when they have only the vaguest sense or awareness of an event. They do have the attendant feeling of it, but they cannot provide details, a timeline, or a narrative. The lack of a narrative occurs because

neurosomatic forms of memorializing do not generate timelines, narratives, or reflection. The gut biome does not track dates and details of events, but how it digests an event—that is, how it generates the meaning of the event—is the memorial process.

The Brain and Getting Slapped

For those of you who focus on the brain, let us give a brain-oriented account of the meaning making of experiencing a slap (Tronick & Perry, 2014). The primary mechanism in meaning making by the brain is the capacity to create associations. When patterns of neural activity co-occur with sufficient frequency, intensity, or pattern, they become "connected" at a synaptic level. But these synaptic connections are not "empty"; they have content. Perry's neurosequential model (Perry, 1999, 2008, 2009) makes it clear that the capacity to weave content—the complex array of sensory, somatic, and cerebromodulatory patterns of activity—into a coherent form, a state of consciousness, is one of the remarkable qualities of development. Indeed, development requires the sequential creation of associations—essentially, sequential meaning making—from outside the body to inside the body to the brainstem and finally to the cortex. Note that while internal signals from the body are *internal* in some way, they are processed by the brain as if they were actually *external*, perhaps one could say as foreign.

Beginning in utero, the meaning-making systems (typically, but artificially, referred to as "body and brain," a linguistic dichotomy, not a physiological reality and not a term we hold to) weave together multiple seamless, interactive, dynamic systems through multiple molecular mechanisms. These mechanisms include the creation of "activity-organized" synaptic nets that begin to create meaning for the developing organism, often the internal rhythms of activation, even when external stimuli are absent. The sensory and somatic "external" inputs from the intrauterine environment (warm, fluid-embracing, nutrient, and hormonal flow; ever-beating maternal heart sounds; the material voice; and the external stimuli of other voices and noises) experienced by the fetus become associated with activity-organized neural activation. For the fetus, this informational flow carries the meaning of being "safe and regulated" (i.e., not hungry, thirsty, cold, or threatened). Of course, to say "safe and regulated" reflects how we as writers and readers are colonized by language. By contrast, for the fetus, it is the form of the operation of its neurosomatic systems with their recurring neural activation rhythms that make and hold the meaning.

Later, in the extrauterine environment, rhythmic rocking, for example, may have a primordial meaning of "safe," a meaning inherent in a coherent somatosensory organization. Moreover, the meaning of rocking may be carried forward and elaborated in extrauterine life. A frightened or overwhelmed child may self-soothe by rocking in the fetal position as an attempt to recapture or to actually create that fetal primordial meaning of "safe." Similarly, other meanings, such as "the world is a dangerous place," are also held by somatic processes, such as the immune system, the autonomic nervous system (ANS), the gut biome, and the HPA axis, as much as by the brain, especially when the child (or adult) is unable to generate coherent patterns of neural activity (Porges, 2011). And like the plasticity of the brain in response to environmental input, these other neurosomatic processes are organized and sculpted by early experiences.

We have one additional note, especially for those who have doubts about the concept of neurosomatic meaning making without language. Research on the Barker hypothesis has found that the fetus generates predictions about the nature of the extrauterine world that affect how they act in the world (Lester et al., 2018; Barker & Osmond, 1986). For example, fetuses exposed to high levels of maternal stress in utero exhibit epigenetic changes and behavioral changes during interactions compared to nonstressed fetuses. That fetuses can make predictions about the extrauterine environment also highlights that an organism can make meaning by using neurosomatic embodied systems even though they not only lack language and symbols but also have an underdeveloped immature brain.

Even though the conscious mind does not have access to the early experience that created the meaning, the meaning is held in neurosomatic systems, which lack time markers, narratives, and images. Neurosomatic meaning making makes it clear that even though the young child's somatic and neurophysiologic systems are far from fully developed, they are a meaning maker. This child has states of consciousness, though with no implication of awareness. Therefore, the infant, even the preterm infant, can fully organize a motivated and embodied state of distress, perhaps even an emotionally fearful state, or a motivated state of pleasure that organizes their actions in the world (Montirosso et al., 2010, 2013, 2014). The former state leads to withdrawal and demands for regulatory support—the latter to engagement and self-directed action on some object or communication with another person.

Thus, the process of meaning making begins with the first experience to create the primary associations (i.e., neural connections) that organize the infant's world. And keep in mind that *all* these neurosomatic systems continue to operate in the adult. They continue to make meaning: the wash of adrenaline after a near-miss car accident when you consciously know everyone is OK, the accelerated heart rate and fear of attack in a dark alley that your friends say is absolutely safe, and the flipping of the stomach at a sudden bump in a plane even though you know it can fly (or can it?). These systems continue to bring the meaning of events from the past into the adult present: the feeling of terror with an ocean wave curling at you from an unremembered thumping by a wave when you were age 5, even though now you know that you are safe. Experimentally, we see it in the fearful and panicky reactions of adults who role-play the still face, even when they are fully informed that it is a role-play (Tronick, 2005).

Returning to the case of a slap, the first time the infant is slapped, the image of a hand moving swiftly across the visual field has not yet been associated with pain. If the slapper is always the same person and others never slap the child, the set of neurosomatic associations may generalize to the properties of those other individuals or the place where the slapping occurs (i.e., the bedroom). The child may begin to feel fearful of the sound of the slapper's voice, the smell of his aftershave, the image of her face, the sound of a door closing, etc. The child also may generalize from the slapper's hand to all hands moving quickly near their face—even if the person is a nurturing caregiver, moving to gently caress the child's face. These associations and the resulting threat-related neurosomatic reactions and behaviors are mediated by the simpler, lower somatosensory and action–motor regulatory systems involved in stress and the threat response.

These more generalized and undifferentiated responses can be quite troubling and mystifying to a child experiencing them, even though such formative experiences are parts of the "known but unremembered" aspects of a person's life. Though unavailable in conscious memory (no narrative, no time marker, and no representational content), they are nonetheless stored in the brain and body's operating patterns, activation preferences, set points, and thresholds; the duration, shape, and refractory period of the response; and other response features throughout the embodied somatic systems. This implicit coding or forming of neurosomatic reactivity is remarkably durable over the life span. Traditional talk therapy may not be sufficient to access these subcortical and other somatic organizers of experience. Directing attentional processes to the body, a core feature of sensorimotor psychotherapy, can stimulate the neural circuits associated with these unrecallable memories, providing opportunities to encode new experiences that support a shift in meaning and, subsequently, a shift in experience (Ogden & Fisher, 2014). Keep in mind that developmental cognitive neuroscience tells us that while most children won't be able to reliably form autobiographical memory until they are roughly 4 years old, they are capable of organizing neurosomatic memorial processes of experiences as early as the later stages of fetal development.

The Sculpting of Neurosomatic and Regulatory Systems by Early Experience and Its Long-Term Effects

This picture of what is going on during development gives us a critical idea of why early experience has such long-term effects. The meaning-making process in infancy is developmentally robust because so many meanings are connected to fundamental regulatory processes and the experiential sculpting effects on the operating characteristics of neurosomatic systems. Thus, many of the associations created early in life are directly linked with the neurosomatic processes—primary regulatory neural networks and primary physiologic processes—that continue to shape and influence the meanings made throughout life unless they are retuned by later experience or interventions. Compared to the adult, however, the infant has less capacity to modulate or shift the meaning because the higher areas of the brain have not yet been fully organized and regulatory processes are still unstable. For example, the infant does not yet have complex time-telling capabilities or abstract cognition to allow them to make a more "abstract" or differentiated meaning about the one abusive slapper compared with other, nurturing carers. While these gaps in capacity make the infant more vulnerable, their organization of the meaning-making process is not as fixed and constrained as the systems are in adults. Thus, infants and young children are simultaneously more vulnerable and more flexible.

As the child becomes older and the limbic and cortical areas of the brain and other neurosomatic systems become more sculpted, the meaning of the slap, the slapper, and the toddler's potential to act in relation to the slapper change. The behaviors that appear to increase or decrease the probability of slapping become more coherent and complex. The infant "learns" (comes to know at an implicit, preconscious level), for example, that crying, (a "fight–flight" stress-related behavior that should bring a carer to meet the infant's distress: hunger, thirst, cold, pain, etc.) will actually increase the likelihood of slapping, whereas dissociating (and not crying) will decrease its likelihood. As a toddler, they may also learn that overly compliant, almost seductive behavior reduces slapping. They may modify their meaning about slapping. For example, let's say their mother—a loving but overwhelmed and frustrated caregiver who never slapped before—slaps the child in frustration when they are noncompliant (noncompliance is *not* possible for them with their actual repeated slapper, but it is with this mother given the history of the two). Almost immediately, there will be a physically nurturing and intimate interaction as the guilty mother attempts to repair the empathetic rupture (not an unusual dynamic with an overwhelmed mother and an abusive partner—the initial slapper). This change in meaning is now possible because of the ongoing developmental advances of neurosomatic systems previously unavailable to the infant and the subsequent behaviors of the mother. The "meaning" of the slap evolves.

This process of changing and creating new associations, new ways of being, requires the plasticity of neural networks and other neurosomatic systems. Fortunately, neurons, neural networks, and other neurosomatic systems are not only capable of change but also specifically "designed" to change in response to experience. The plasticity underlying both developmental change and therapeutic change has features that will enhance and others that will inhibit meaningful change (Kleim & Jones, 2008). Two primary principles of plasticity are specificity and pattern. Simply stated, neural networks that are not being activated with sufficient repetition in a significant pattern will not change or may even be pruned away. On the other hand, networks that are repeatedly activated will become stronger. Thus, if a child or infant has built a fear association around a slapping caregiver, that neural network can become stronger, not only with each subsequent slap but also with every interaction where the network is turned on by the child's fearful prediction of a possible slap. Importantly, plasticity, or the adaptation of systems to significant events, applies to all neurosomatic meaning-making systems, such as the ANS and the HPPA axis, which are sculpted by early and ongoing, repeated experiences.

Trauma Never Occurs Only Once

The repetition principle underlying plasticity or sculpting brings us back to our view of trauma (Hebb, 1949). The principle of repetition implies that there is no such thing as an acute singular traumatic event, an event that happens only once. It is an ongoing process. We do not aim to be difficult when we claim that the principle is both false and true. Allow us to state the point in the extreme: Singular acute traumatic events are not different from repeated events. The meaning of an event is internally reiteratively processed by a child over time, maybe over a lifetime: It lingers, pokes, prods, intrudes. Second, the meaning of the event is affected by and affects the meaning that the child makes of other events; their meaning is not static or fixed. Take an example other than a slap, the acute event of a never-to-be-repeated sexual abuse of a young girl by a stranger never to be seen again. It happens only once; it is singular, but is it really? Certainly, it is what we point to as *the* trauma (e.g., in our case report) and, yes, it *can* have lifelong effects, but not in the sense that it is a "thing," a lesion, an object deep in the psyche of the child. From a developmental meaning-making perspective, the trauma is not singular. The occurrence of abuse *is* singular, but the meaning of it is not anchored like a crystalized rock in the psyche. The processing of the meaning is ongoing; in that sense, it is repeated and can have lifelong detrimental effects.

To start, there are internal neurosomatic meaning-making processes—the autonomic nervous system, the HPA axis, and the brain processes of memory, rumination, perseveration, and dissociation—that continue to operate on the meaning of the event. Infants become more distressed when seeing the still face 2 weeks after seeing it the first time (Montirosso et al., 2014). Its meaning has been repeatedly *re*processed. The operation of these neurosomatic meaning-making processes actually alters the meaning over time, even if the child is not aware of the change. In the case of children, the meaning-making processes continue to develop (e.g., cortical processes come online and the operation of the HPA axis stabilizes), further changing the meaning of the event.

Second, the meaning of the acute event affects the meaning of other experienced events. One obvious process is how the young girl's initial meaning of the event—"I was too trusting"—affects and is affected by future interactions. Perhaps that meaning disrupts her relations with others, which in turn makes her even more distrustful. Then those newly emerging meanings have their effects on the meaning made of subsequent events. Third, the acute event itself does not exist in isolation. It is affected by *all* current and ongoing experience. The "all" includes what was going on when the event occurred, the meaning being made of other events, and the over-time evolving context of the event. Perhaps the young girl's other ongoing relationships may so robustly contradict the distrust that they give her a sense of safety and certainty, which in turn makes her more trustful, or perhaps one of the adults in her life resembles the abuser, and his presence repeatedly triggers her fear and distress. Just as likely, some other outcome emerges from the vast variety of experiences that she may have. Simply put, we cannot know or predict what meanings will emerge over time given her ongoing experience and development. To refer to the event as a trauma does not give us any traction on what it means to her now. In a word, the details—the moment-by-moment flow of events and meanings—matter in how the experience will play out.

This account of what we refer to as a single one-time-only traumatic event when we talk about our patients should, I hope, make it clear that an event is repeatedly experienced and transformed. Nonetheless, there are differences between the singular event and repeated events. An event that is repeated triggers the host of processes again and again. Its effects are more likely to accumulate, be more intense, and affect a wider range of experiences and the child's sense of their world. Nonetheless, the repeated event is in the context of other events, and there is a high likelihood that they too will be repeated and that they will be distorted and pathologized. As with the slap, if the young girl is repeatedly abused, the likelihood that the rest of her world will be

"normal" is vanishingly small. In fact, the distortions of the rest of her experience will further exacerbate the consequences of the "event." Escaping their effects will be more difficult.

Multiple Therapies for the Meaning of an Event(s) by Multiple Meaning-Making Systems

How does the evolution of the complex archeology of the meaning of the slap, peek-a-boo, being with another, or any way of being relate to therapy? For us, therapy is about changing meanings. How do we see the change process? Obviously, a myriad of driving forces and systems are involved. These systems are inherent in making and changing meaning, including somatic and regulatory systems, neural systems, and action systems; the list of somatic processes could go on and on. Our view of therapeutics is very much that of Vygotsky (1978): Optimal development in any domain (e.g., neural, regulatory, motor, and sensory) occurs when the child is given opportunities and expectations, usually by or with another person, that are neither too familiar and simple nor too unfamiliar and complex (Perry, 2009; Tronick, 2007). The child with a psychic dysfunction has to be allowed to select or guide the information that they are presented with such that it fits and can be worked on by her meaning-making capacities to make new meanings. Presenting something or doing something that is beyond their ability to operate on (Piaget referred to this ability to operate as assimilation) will not lead to new meanings; the item can't be "digested."

We emphasize (Tronick & Beeghly, 2011) that therapeutic work with infants and young children must aim to deeply understand their intentions, the multilevel meanings that children are making about themselves, and how they are making them within themselves, by themselves when engaging the world of things, and, most importantly, with others. In adults, it is critical to determine where the meaning "resides." It may reside in the prefrontal cortex (as is presumed by cognitive therapies). Still, we believe much of it resides lower down in the brainstem and in regulatory and somatosensory processes (as presumed by somatic therapies). This multiplicity of neurosomatic processes demands forms of therapy that reorganize those processes through recurrent experiences. With success, thanks to awareness, some of the distorting experiences emerge in communicable forms.

One implication of the multiple kinds of meaning-making systems is that therapy cannot simply or solely focus on just one system, be it the somatic, neural, action, cognitive, or emotional systems. What development tells us about meaning making and changing it is that it involves multiple systems simultaneously operating as a messily organized ensemble. More specifically, change requires a child who has agency who organizes their engagement with the world, especially the world of people, with every level and every meaning-making system that they possess. But development also tells us that therapeutically induced change in meaning must enact the first principle of recurrence. The child must have the opportunity to engage and re-engage in new external and internal experiences that can generate new associations and operations of the systems that are at the core of meaning making.

The demand for enough experience to engender change is especially critical when we consider early meanings that are interwoven with fundamental somatic and regulatory processes. Admittedly, we don't know what "enough" is, but we do know that seldom is there enough recurrent experience in those systems (e.g., the bedrock associations created by our earliest somatosensory experiences in the lower areas of the brain). Also, most targeted therapeutic efforts do not adhere to the core principle of specificity; *non*somatic therapies in and of themselves will not directly or repetitively activate the foundational somatosensory systems (and related associations) made in early life and localized in the lower systems in the brain. Somatic therapies will not directly affect or repetitively activate higher-order brain systems. Thus, as we argued from the beginning, meaning making and therapeutic change involve a simultaneity of systems

at all levels of the hierarchical organization of the brain and body.

More specifically, our emphasis is on the implications that the multilevel psychobiological nature of meaning making has for therapeutic interventions targeting trauma. No single therapeutic approach, no matter how powerful, will be an adequate therapeutic intervention. Trauma therapy, as well as any therapy for any problem, must employ multiple selected methods of therapeutic approaches. The available methods include somatic, verbal, neurophysiologic, medical, pharmaceutical, relational, experiential, narrative, video, all the therapies that are alphabetically identified (CBT, DBT, and EMDR), and others too numerous to mention. With respect to all our colleagues, we suggest that claims to the contrary about this or that particular therapy's treating all trauma are like the claims about snake oil: "step right up, folks; the elixir will cure everything." Whether or not you accept the concept of multiple psychobiological processes' making meaning, you must admit that trauma is complicated and that simple solutions, quick solutions, or singular solutions will not—cannot—be adequate.

At the same time, choosing therapeutic methods is not simply a matter of being eclectic. The developmental perspective of neurosomatic meaning making presented here can guide the selection. The challenge of a multiple-method therapeutic approach is initially figuring out what is the neurosomatic form—the meaning—of the trauma. In particular, the challenge is figuring out in which system the meaning might "reside" and then specifying a therapeutic approach that gets at that form. For example, in many cases, Perry (2009) has found that the trauma resides in the diencephalon, but not in all cases. Sometimes, he has found that it resides in cortical areas. Teicher et al. (2016) have shown changes in a number of other brain regions associated with age and developmental changes in adults with a history of childhood abuse and neglect. Earlier, we discussed associative learning and epigenetic changes. Porges (2011), by contrast, would emphasize the role of the ANS and the vagal system. Analysts would emphasize unconscious processes. Tronick (1989) and others (Harrison, 2003; Seligman, 2017) would look at relational processes. Of course, figuring out which system one should initially focus on is not a simple task. However, there are emerging methods for determining an initial target. Perry (2009) suggested carrying out an evaluation of different behaviors to identify the brain area that was affected by a trauma. Porges (2011) suggested methods for the identification of vagal reactivity and arousal related to safety. Other techniques, including EEG, MRI, and genetic analysis; somatic, play-based, and dyadic evaluations; and even projective techniques, can also be used.

Second, once the putative system has been identified, specific therapeutic techniques can be narrowed down. Upon finding a problem in the lower brain structures, Perry (2009) would emphasize rhythmic therapeutic activities. High vagal reactivity would lead Porges (2011) to focus on neural exercises that generate a feeling of safety. A somatic problem, such as the anxiety generated by the violation of the person's relational space, would be treated by Ogden and Fisher (2014) with activities modulating the distance between the patient and the therapist. Upon seeing EEG distortions, van der Kolk might suggest neurofeedback (van der Kolk et al., 2016). An epigeneticist might aim to generate a molecular signal by using a drug, such as propranolol, that works on extinguishing memorial processes (Davis et al., 2006; Pizzimenti & Lattal, 2015; Bernardi & Lattal, 2010). Upon seeing unconscious issues, a psychoanalyst would suggest play therapy (Harrison, 2003). Upon seeing relational problems, a relational therapist would focus on dyadic therapy (Seligman, 2017; Tronick, 2007; Lieberman et al., 2015).

The therapeutic work does not end with the initial identification or the initial treatment. As the therapeutic work proceeds, the dynamics of the change induced by the intervention must be tracked. Also, the neurosomatic form of the trauma will change. For example, for an out-of-awareness somatic problem to come into awareness as an autobiographical memory with successful somatic treatment, a change from the somatic therapeutic approach will be required.

Perhaps neurofeedback works on weakening the autobiographical memory that now resides in various parts of the cortex. Because these changes are dynamic and *ongoing*, it may become necessary to figure out which next intervention will gain traction on the changed representation of the trauma.

But what we know about identification, multiple forms of therapy, and how to move through an array of therapies should not be overstated. To get at this multiple approach, we need far more research and a change in training away from a one-size-fits-all approach. We could think of therapists trained in multiple therapeutic approaches and/or a team approach to therapy. At the core, the challenge for research and therapy is to figure out what to work on, what approach to use to change it, and when to again switch to another approach.

From a developmental perspective, not only is social interaction the foundational mechanism of change, but it is also fundamental to therapeutic change. Children and adults live in a world where an hour of any kind of therapy is lost in the welter of all the other hours of their lives. If the people in the child's life are not part of the process of change, then change will not occur. The therapeutic effects become diluted, overridden even with several hours of weekly therapy. Children need to be immersed in therapeutic others. Thus, what makes sense for us as a guide for therapy is to take our cue from the development of meaning: Approach therapeutic change like learning peek-a-boo. Do it often, do it in multiple ways that fully engage every level of the child, and let the child's agency control the process. To only be trauma informed and wedded to one approach and one outcome is to fail to understand the need to be developmentally informed to gain traction with the whole dynamically changing child.

Summary and Key Points

In this paper, we provide an alternative view to the idea of trauma seen as acute severe events and as major causes of psychopathology. The view is anchored in developmental neuroscience, which sees lifelong functioning resulting from repeated experiences and processes. The metaphor of learning a game through repeated, reiterated experience and developmental changes in capacity was suggested as a way to better understand the nature and effects of chronic experience. The game metaphor makes it clear that the effects of experience are individualized, relational, and culturated. More formally, as biological open dynamic systems, humans must continuously appropriate environmental resources. The developmental functioning of a child and the quality of the resources available for appropriation affects and shapes the typical or atypical form and quality of that functioning (Hunter & Tronick, 2020; Tronick, 1998; Sander, 1977; Harrison, 2003). The nature of experience, aspects of brain development, and mechanisms of incorporating environmental resources and how these shape typical and atypical development were discussed. Furthermore, we argued that trauma-informed viewpoints, in contrast with developmentally informed viewpoints, limit our understanding of how events, traumatic or mundane, affect functioning, resulting in psychopathology.

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28

Parental Substance Use: Implications for Infant Mental Health

Madison R. Kelm, Rachel A. Level, and Rina D. Eiden

Parental substance use disorder (SUD) and substance use during pregnancy are chronic public health concerns with adverse effects on family processes and child development. Although prevalence rates for parental SUD are difficult to estimate due to underreporting given social stigma and fear of child protective services, data from National Surveys on Drug Use and Health indicate that approximately 1 in 8 children (8.7 million) had at least one cohabiting parent with SUD (Lipari & Horn, 2017) and around 15% of infants (550,000 infants) are born with prenatal substance exposure (CBHSQ, 2021). In this chapter, we discuss the literature on parental SUD/pregnancy substance use and co-occurring risks, associations with parenting, and infant mental health outcomes. Specifically, we discuss the literature on (1) child behavioral, socioemotional, cognitive, and physiological outcomes associated with prenatal and postnatal substance exposure; (2) co-occurring risk factors associated with family SUD; (3) family processes and parenting behaviors associated with parental SUD; and (4) highlight future directions for research as well as prevention and treatment.

Although some studies have shown substance-specific risk factors and outcomes, the field tends to focus on or refer to parents with alcohol and drug-related problems as one group. Therefore, our review of the current literature adopts that terminology but also includes studies involving alcohol-, nicotine-, cannabis-, cocaine-, and opioid-dependent parents. Notable findings that exclusively or primarily focus on a particular substance are specified as such (e.g., "parents with opioid use disorder").

Methodological Considerations

Because the type of substance as well as dose, timing, and duration of exposure and family history and postnatal factors collectively contribute to developmental outcomes in complex and often interactive ways, understanding the methods used to most accurately and completely assess parental/caregiver substance use is necessary. One of the most commonly used assessments of parental substance use is self-report measurement. For practical and financial reasons, in studies using large samples, these assessments are typically no more than a few questions and may be asked retrospectively. This often only allows for a dichotomous classification of parents as

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users or nonusers and limits the examination of potential dose–response effects. In one of the few studies examining measurement issues, Pickett et al. (2009) reported lower congruence among retrospective recall of substance use and prospective measures and biological assays, particularly among heavier users. Indeed, in a study comparing single-item self-report measures with a structured calendar-based interview and salivary biomarkers in pregnancy, single-item measures of pregnancy smoking did not predict fetal growth outcomes, but the other two methods accounted for significant and comparable variance in fetal growth (Shisler et al., 2017). About 15–25% of those who self-identified as nonsmokers based on the single-item measure were ascertained as smokers based on the other two methods, highlighting the importance of more intensive measurement.

Parental substance use is also measured using objective biological indicators including urine, saliva, hair, sweat, meconium, and cord blood/placental tissue. However, some biomarkers only detect recent use and cannot reliably distinguish substance quantity or frequency from recency of use (urine and saliva; Dolan et al., 2004). Although other biomarkers such as hair and blood have longer windows of detection, they are relatively difficult to collect and expensive to process (Moeller et al., 2008). Because of the limitations of each method, there is no single "gold standard" measurement for substance use (Konijnenberg, 2015). Instead, the use of multiple methods such as intensive calendar-based parental self-report (e.g., TLFB; Sobell & Sobell, 1992), as well as biomarkers of use, may yield more accurate estimates.

In addition, there are limited studies using nationally representative samples, thus limiting the generalizability and applicability of findings (Havens et al., 2009). Large, representative samples with demographically similar non-substance-using parents, or propensity score analyses for comparison, are necessary to draw substantive conclusions about the effects of parental substance use (Engle & Black, 2008). Finally, elements of study design such as prospective, longitudinal measurement using multiple methods as opposed to cross-sectional, retrospective reports, oversampling for parental substance use with careful consideration to measurement, and using genetically informed designs are important components of well-formulated research with substance-exposed families.

Effects of Prenatal Substance Exposure on Infant Development

Perinatal outcomes associated with prenatal drug and alcohol exposure may vary with substance, dose, timing, and duration of exposure. Given evidence of both equifinality (multiple developmental pathways or processes may lead to the same outcome) and multifinality (a single risk condition may lead to multiple developmental outcomes) with regard to infant and toddler outcomes associated with prenatal exposure (Cicchetti & Rogosch, 1996), characterizing commonalities and discrepancies is imperative to understanding developmental trajectories across the lifespan. Adverse perinatal outcomes may be one process for later child risk.

Perinatal Outcomes

Maternal perinatal outcomes include an increased risk of miscarriage, preterm delivery, placental abruption, and placental previa (Louw, 2018). Prenatal exposure to several substances including alcohol, tobacco, cannabis, opioids, and cocaine has been independently associated with restricted intrauterine growth, preterm birth, low birth weight, and small gestational age for infants (Behnke et al., 2013; Forray, 2016; Guille & Aujila, 2019). While growth deficits related to some substances such as tobacco generally do not persist past the second year of life (Behnke et al., 2013), heavy prenatal alcohol exposure may result in long-term growth restriction (Behnke et al., 2013; Forray, 2016).

Fetal Alcohol Spectrum Disorders and Neonatal Opioid Withdrawal Syndrome

While some physiological effects of prenatal exposure are common across substances, exposure to specific substances that are highly teratogenic during the prenatal period, such as alcohol, often results in co-occurring clusters of symptoms. Recent estimates suggest that each year in the United States, an estimated 31.1–98.5 per 1000 infants (May et al., 2018) are born displaying symptoms known collectively as fetal alcohol spectrum disorders (FASD). In addition to low birth weight and prematurity, FASD may be characterized by long-term growth retardation, facial dysmorphia, delays in motor development, and neurobehavioral difficulties including intellectual disability, difficulties with executive function, and seizures (Guille & Aujila, 2019). For a more detailed review of FASD, please see May et al. (2009). Some substances such as opioids are also associated with withdrawal symptoms after birth, referred to as neonatal opioid withdrawal syndrome (NOWS). Recent estimates suggest that around 60% of infants exposed to opioids during gestation experience NOWS (Patrick et al., 2012), which is characterized by symptoms of withdrawal including tremors, hypertonia, seizures, irritability, high-pitched cry, poor alertness and orientation, lability, difficulty feeding, and respiratory distress (Forray, 2016). Importantly, recent evidence suggests that although they may increase the risk for NOWS, medication-assisted treatments for opioid use during pregnancy such as buprenorphine and methadone are not associated with maladaptive developmental sequelae such as behavioral and cognitive difficulties during early childhood (Kaltenbach et al., 2018). Given inconsistencies in the prevalence of NOWS and limited research on long-term outcomes in opioid-exposed infants, understanding potential factors such as type of opioids, duration of use, dose and timing of exposure, and polysubstance exposure is critical. Similarly, examining potential moderators, including maternal mental and physical health with adequately powered samples to investigate these complexities, is crucial but challenging. Multisite studies that oversample for substance-exposed pregnancies such as the Healthy Brain and Child Development Study (HBCD; U01 DA055361-01, NIDA; https://heal.nih.gov/research/infants-and-children/healthy-brain) may help address these important issues.

Physiological and Behavioral Outcomes

A small but robust body of evidence indicates the effects of specific substances on decreased regulation of arousal measured both behaviorally and physiologically. For instance, exposure to substances such as cocaine, tobacco, opioids, and amphetamines is associated with lower autonomic regulation during periods of rest and in response to stress or challenges. However, many of these substances are used together, reflecting a pattern of polysubstance use (Behnke et al., 2013; Schuetze et al., 2007). Some of this literature highlights sex-specific effects of prenatal exposure on the sympathetic nervous system's functioning shortly after birth such that male infants exposed to cocaine exhibit more cortisol reactivity than female infants (Eiden et al., 2009b). However, the role of a child's biological sex has not been well examined in this field (Coles et al., 2012). Overall, results are somewhat mixed for cortisol (stress hormone) reactivity in response to stress (e.g., Eiden et al., 2020b), but more consistent for autonomic regulation.

In addition, prenatal substance exposure has been associated with numerous behavioral outcomes across early childhood. For instance, infant and toddler behavioral outcomes related to prenatal alcohol and tobacco exposure may include externalizing behaviors, hyperactivity, aggression, and conduct disorder during childhood and adolescence (Forray, 2016; Guille & Aujia, 2019; Estabrook et al., 2016), with more in utero exposure associated with more behavioral difficulties. Recent evidence indicates stronger effects for tobacco and cannabis co-use compared to tobacco alone. Indeed, co-use has been associated with a lower ability to regulate arousal

and attend to the environment across the first month of life (Stroud et al., 2018), highlighting the role of polysubstance exposure. While there are relatively well-defined behavioral outcomes associated with prenatal exposure to tobacco and alcohol, there is inconsistency in findings related to behavioral effects of other substances, with many studies reporting findings based on retrospective and cross-sectional studies with limited measurement of potentially confounding sociodemographic and other risk variables (Jones et al., 2015). These mixed results highlight the need for methodologically rigorous, longitudinal research designs aimed at disentangling the influence of prenatal substance exposure and other risk factors, as well as moderating factors such as parenting.

Cognitive Effects

A number of cognitive outcomes have been associated with prenatal substance exposure in early childhood. For instance, difficulties related to executive functioning have been associated with prenatal exposure across most substances, with the most robust findings for tobacco and alcohol and more mixed results for substances such as cannabis, cocaine, methamphetamines, and opioids (Guille & Aujila, 2019). In addition, prenatal exposure to tobacco and alcohol has been independently associated with difficulties developing and using language (Behnke et al., 2013), perhaps due to deficits in sensory encoding of auditory stimuli (Kable et al., 2009). Thus, across physiological, behavioral, and cognitive domains, there are numerous and variable outcomes associated with prenatal substance exposure. Given the heterogeneity in outcomes, it is important to consider risk and protective factors that may moderate these pathways. We summarize some major outcomes by exposure in Table 28.1.

Heterogeneity of Outcomes

While there is robust evidence supporting the relationship between parental substance use and a broad range of negative child outcomes, there are also substantial individual differences in these associations that merit further investigation. Indeed, studies examining the direct effects of parental substance use on children's development tend to report small to moderate effect sizes and reflect heterogeneous parental and child outcomes (Austin et al., 2022). Thus, while many families show negative consequences when exposed to prenatal substance use, a significant proportion do not, highlighting the importance of the postnatal environment.

In addition to pervasive co-occurring risk factors, many parents use multiple substances with polysubstance use being implicated in poorer health and parenting outcomes (De Genna et al., 2019) including overdose deaths (Cicero et al., 2020). Substantial evidence also suggests that parents with SUD often have concurrent behavioral and mental health issues, such as antisocial behavior, depression, and anxiety (Castillo-Carniglia et al., 2019; Leonard & Eiden, 2007), may experience low partner satisfaction, including high rates of relationship conflict (Levitt & Leonard, 2018), and experience greater exposure to community violence (Zhao et al., 2022). These psychosocial factors may moderate the association between substance use and child outcomes. Additionally, because not all substance use is associated with negative effects on children (Kepple, 2018), it is likely that certain personal and environmental factors may also buffer the aversive effects of substance use. In fact, social support has been found to influence the effect of parental substance use on child development, both directly through providing social control, role models, and social bridging to other people and indirectly through improving parents' mental health (Olstad et al., 2001). Elucidating risk and protective factors associated with parental substance use may present unique and specific targets for intervention. To that end, specific risk and protective factors are addressed later in the chapter.

Table 28.1 Effects of prenatal substance exposure on infant and toddler outcomes

Substance	Physiological effects	Behavioral effects	Cognitive effects
Alcohol	Preterm birth, low birth weight, FASD, congenital anomalies, motor abnormalities, poor postnatal growth, delayed motor development, seizures	Poor habituation, low arousal, adaptive behavior problems	Attentional difficulties, lower IQ scores, difficulties with memory and overall executive functioning, difficulties with development and use of language
Tobacco	Preterm birth, low birth weight, small for gestational age, oral facial clefts, hypotonia, increased risk of SIDS	Negative affect, decreased soothability, impaired orientation, impulsivity, externalizing behaviors, emotion dysregulation, difficulties with peer interaction, aggression	Learning and memory difficulties, lower IQ scores, poor language development
Cannabis	Low birth weight, small for gestational age	Impulsivity	Attentional difficulties, deficits in sustained attention, learning and memory difficulties
Cocaine	Preterm birth, low birth weight, small for gestational age, poor autonomic regulation, poor postnatal growth[a]	Behavior problems[a]	Attentional difficulties, memory and perceptual difficulties
Opioids	Low birth weight, withdrawal/NOWS, feeding difficulty, hypertonia, decreased autonomic regulation, seizures, respiratory distress	Irritability, lability, high-pitched cry, decreased behavioral regulation, poor alertness, poor orientation, hyperactivity	Attentional difficulties, memory and perceptual difficulties
Amphetamines	Preterm birth, low birth weight, decreased arousal	Increased neonatal stress response	Difficulties with inhibitory control, increased risk for impaired executive functioning

Note. SIDS Sudden infant death syndrome, *FASD* fetal alcohol spectrum disorder, *NOWS* neonatal opioid withdrawal syndrome
[a]Conflicting findings

Moderators of Risk

Sociodemographic Risk Factors: Poverty, Nutrition, and Medical Care

In order to best conceptualize the developmental pathways to risk and resilience, it is important to understand the contexts within which parental substance use often occurs. Parental substance use is associated with a number of individual and psychosocial factors. For example, mothers who use tobacco and illicit substances during pregnancy were more likely to be single, have less formal education, have fewer prenatal visits, and were more likely to use federal financial assistance (Arria et al., 2006). Other broad risk factors associated with parental SUD include poverty (Walker & Druss, 2017), poor nutrition and chronic health conditions (Jeynes & Gibson, 2017), lack of access to antenatal medical care (Louw, 2018), symptoms of psychopathology (Zilberman et al., 2003), experience of early adversity and child maltreatment (Abar et al., 2013; Guille & Aujila, 2019), and increased exposure to intimate partner violence (Hedin & Janson, 2000). In addition to potential biological vulnerability related to prenatal substance exposure and effects related to postnatal secondhand exposure (e.g., to tobacco), these co-occurring risk factors may have additive or synergistic effects on family processes and developmental outcomes.

In a systematic review of the literature, Karriker-Jaffe (2011) noted that substance use outcomes tended to cluster by geographic area, and there was some support for neighborhood disadvantage to be associated with more disordered use of alcohol and illicit substances other than cannabis. Using data from the National Panel Study of Income Dynamics, Patrick et al. (2012) reported that smoking combustible cigarettes was more common among those with low childhood family socioeconomic status (SES). However, alcohol and cannabis use were more common among those with higher family SES (Patrick et al., 2012), again suggesting that the association between poverty and substance use/disorder varies by substance among nonpregnant populations. Women who are unable to stop using substances during pregnancy and parents with SUD are more likely to experience poverty (Havens et al., 2009), although these associations may be bidirectional, with heavier use and addiction leading to higher risk for job loss (Schaller & Stevens, 2015). In addition, poverty increases the risk of poor nutrition which may contribute to the development of SUD (e.g., nutrient imbalance predicting higher substance use, Schroeder & Higgins, 2017) and may also be exacerbated by heavy use. In fact, SUD has been shown to decrease appetite (Neale et al., 2012) and inhibit the body's access to nutrients (Egerer et al., 2005). Parents with SUD also frequently experience chronic mental and physical health conditions, including health conditions related to obstetric complications (Louw, 2018). Additionally, for women and child-bearing individuals, prenatal and postnatal substance use are associated with reduced access to medical care (Nidey et al., 2022). Separately and concurrently, these risk factors may exacerbate the effects of prenatal and postnatal substance exposure and increase the risk for adverse childhood experiences including risk for maltreatment (Smith & Testa, 2002). Given continuity in parent and child sociodemographic risk factors in substance-exposed families, substance use may be considered a marker of risk for intergenerational transmission of nonoptimal health outcomes.

Symptoms of Psychological Distress

In addition to associations with physical health outcomes, parents with SUD experience greater symptoms of psychological distress. There is consistent evidence of higher psychological symptoms or comorbid mental health diagnoses among women with substance use or SUD in pregnancy that include symptoms of depression (Arnaudo et al., 2017), anger/hostility/aggression (Eiden et al., 2011a), and general psychological distress (Arnaudo et al., 2017; Eiden et al., 2007). These co-occurring psychological distress symptoms continue into the postnatal period, with robust literature linking prenatal and postnatal

maternal psychological distress to child outcomes either directly or indirectly via effects on family processes and parenting behavior (Leonard & Eiden, 2007). In contrast to the literature on mothers which includes a diversity of substances, the literature on fathers is mostly limited to fathers with alcohol use disorder (AUD), with a few exceptions (e.g., Stover & Coates, 2016). Longitudinal studies spanning infancy/early childhood to late adolescence (e.g., the Buffalo Longitudinal Study; see Fitzgerald & Eiden, 2007) indicate consistent associations between fathers' AUD and higher depressive symptoms for both fathers and mothers, as well as robust linkages with higher paternal and maternal antisocial behavior (Fitzgerald & Eiden, 2007; Godleski et al., 2020). Empirical evidence also supports spillover effects such that substance use and co-occurring psychological symptoms may lead to poor relationship satisfaction and increased partner conflict (Leonard & Eiden, 2007; Wee et al., 2011) and spill over to more negative parent–child interactions (Finger et al., 2010), with cascading effects on child development (e.g., Eiden et al., 2016; Fitzgerald et al., 2000).

Early Adversity and Child Maltreatment

In addition to concurrent physical and mental health risk factors, substance use during pregnancy and SUD are robustly associated with exposure to early life adversity (ELA) including poverty, trauma, household chaos (Dube et al., 2003; Shand et al., 2011), and child maltreatment (Cicchetti & Rogosch, 2018; Cicchetti & Handley, 2019). The timing, severity, and duration of ELA exposure as well as sex and gender differences (Shand et al., 2011), social support (Liu et al., 2020), and individual variability in response to stress (Hartmann & Schmidt, 2020) result in heterogeneity in outcomes related to substance use and SUD (Sheridan & McLaughlin, 2014). However, from a developmental psychopathology perspective of adult substance use and SUD, exposure to ELA represents a disruption in normative caregiving experience that has cascading effects on development across the lifespan (Cicchetti & Rogosch, 2018). Indeed, ELA exposure has been identified as a risk factor for adult SUD across multiple substances including alcohol, tobacco, cannabis, opioids, and cocaine (Goldstein et al., 2013; Mills et al., 2017; Santo Jr. et al., 2021; Hyman et al., 2006). For parents who have experienced childhood maltreatment, using substances may be a way to manage symptoms of stress and psychopathology related to their experience, particularly during pregnancy as they prepare to parent, a significant life event which may bring up traumatic memories from their own childhood (Davis & Narayan, 2020). Although there is significant heterogeneity, prenatal and postnatal exposure to substances has been associated with increased risk for and substantiated child maltreatment (Austin et al., 2022; Dunn et al., 2002). Compounding this risk, children of parents who experienced child maltreatment are more likely to be maltreated themselves, potentially perpetuating the intergenerational transmission of maltreatment (Assink et al., 2018).

Substance Exposure and Interpersonal Conflict

Although substance exposure has also been broadly related to interpersonal violence (Hedin & Janson, 2000; Shand et al., 2011), it is important to note that this relation is nuanced and complex. For example, alcohol and other substance use have been identified as risk factors for nonfatal injuries from family violence (Kyriacou et al., 1999), and particularly for women, substance use has been associated with increased exposure to intimate partner violence (IPV) by a romantic partner (Shand et al., 2011). Indeed, one study found that women arrested for domestic violence were more likely to experience sexual coercion on days when they used cocaine (Stuart et al., 2013). In addition, women were more likely to both perpetrate and experience physical violence on days that they drank alcohol at all or drank heavily (four or more drinks on one occasion;

Stuart et al., 2013). Research also suggests that partner use of substances such as tobacco and alcohol is associated with experience of physical violence for pregnant persons (Hedin & Janson, 2000) and maternal experience of previous and concurrent IPV have been associated with both maternal and partner SUD (Dennis & Vigod, 2013). Similarly, two separate reviews concluded that substance use increases the likelihood of IPV among men, though the association has been shown more clearly for alcohol than other drugs, and may depend on drug type (Shorey et al., 2011).

Adding further complexity, some studies indicate that in the context of romantic relationships, low to moderate levels of substance use are predictive of positive relationship outcomes, such as intimacy (Levitt & Leonard, 2018). More specifically, concordant substance use—that is, when both partners use a similar amount—is associated with more adaptive outcomes, such as relationship satisfaction (Homish & Leonard, 2007; Levitt & Leonard, 2018), although heavy substance use has been consistently associated with maladaptive outcomes, such as relationship dissolution, even in the context of concordant use (Wiersma & Fischer, 2014). Discordant alcohol and illicit substance use—that is, when one partner uses heavily and the other uses lightly or abstains—predict lower couple intimacy and relationship satisfaction across time (Homish & Loenard, 2007). Findings from a longitudinal study of couple relationship functioning involving newlyweds (Leonard & Mudar, 2003) suggest that heavy use of alcohol, but neither concordant nor discordant use of marijuana or tobacco, predicted relationship dissolution (Leonard et al., 2014). Thus, evidence suggests that different substances may operate distinctly to either increase or decrease the risk of conflict in romantic relationships.

Parenting

Another factor that may contribute to the heterogeneous outcomes associated with parental substance use is parenting. Parenting is one of the most proximal and salient development contexts affecting child behavior (Bronfenbrenner, 1979). However, parenting is adversely affected by SUD, with significant evidence indicating that parents who misuse substances show notable differences in cognitive, neural, and affective processes associated with caregiving. Therefore, differences in parenting associated with substance use may be one significant pathway through which parental SUD influences child adjustment and development (Table 28.2).

Parental SUD, more than most other psychiatric or social problems with the exception of poverty, is the most common factor underlying child welfare referrals because of suspected parental abuse or neglect (Brook & McDonald, 2009). Observations of mother–child interactions involving mothers with histories of illicit drug use (e.g., heroin, opioids, and cocaine) indicate lower sensitivity and unresponsiveness to infant's emotional cues compared to demographically similar non-substance-using mothers (Goldberg & Blaauw 2019; Peisch et al., 2018). Substance use may also be associated with more disengagement, lack of pleasure in the interaction or attention to the infant, and poorer attention to the infant's cues (Eiden et al., 2011b; Strathearn & Mayes, 2010). In addition to less engaged and sensitive parenting, research studies have established a robust relationship between parents' substance use and child maltreatment (Goldberg & Blaauw, 2019). Parental substance use is associated with harsher disciplinary practices, including authoritarian parenting and escalated discipline starting in infancy (Stanton-Tindall et al., 2013). Parental substance use may also be associated with significant differences in parents' attitudes and beliefs about parenting. Mothers who use substances may have lower beliefs in their parenting efficacy (e.g., emotional availability, nurturance, protection of the child from harm or injury, discipline, and limit setting; Salo et al., 2009) relative to community samples, but interestingly stronger beliefs about exerting authority over their child (Bauman & Levine, 1986). Importantly, some studies have shown no negative impact of parental substance use on parenting, with some framing sensitive parenting as a

Table 28.2 Parental risk factors and behavioral effects of parental substance use

Substance	Risk factors	General effects	Parenting effects
Alcohol	Started drinking at an early age, single status, unemployed, family history of AUD, mental health problems, history of trauma, friends/partner who drink, bariatric surgery	Lowers inhibitions (may lead to risky or reckless behaviors), impairs judgment, diminishes motor coordination, may increase aggression	Increases risk for infant neglect, risk of child injury, decreased sensitivity to infant cues, increases in harsh parenting, chronic use increases the risk of rage, depressive episodes (unstable environment)
Tobacco	Younger age, single status, unemployed, family history of smoking, mental health problems, friends/partner who smokes, other substance use	Immediate sense of relaxation (parents may use to manage negative affect), withdrawal may contribute to low mood (irritability, anxiety, difficulty concentrating), chronic use may exacerbate mental health symptoms	Parents who rely on smoking to cope may have more difficulty regulating emotions when caregiving, withdrawal may magnify the intensity of infant cries, increased risk of second- and third-hand smoke exposure
Cannabis	Younger age, unemployment, nausea during pregnancy, family history of cannabis use, mental health problems, friends/partners who use cannabis	Slows nervous system functioning (calming effect), impairs memory and motor coordination, impulsive behavior, difficulties thinking /problem-solving, chronic use may increase aggression and hostility	May reduce a parent's ability to pay attention, make decisions, react to emergencies (may miss signs of danger/infant cues), may increase risk of harsh parenting
Cocaine	Single status, unemployment, family history of alcohol/drug problems, history of childhood abuse, less social support, mental health problems, antisocial personality disorder, current partner who uses substances, chaotic living situation, other substance use	Sudden influx of energy, heightened senses (colors, smells, sounds), prolonged use may increase irritability, hostility, aggression, psychotic distortions in thought increasing paranoid hostility	Child crying may be more intense/overwhelming, misperceptions of child intentions may make parents more hostile/impatient with their child, disrupted neural pathways may make parent-child interaction less rewarding (decrease in parent engagement)
Opioids	Family history of alcohol/drug problems, mental health problems, other substance use, lower back pain during pregnancy/postpartum	Blocks transmissions of pain signals to the brain, produces euphoria followed by drowsiness, chronic use can result in tolerance, dependence, withdrawal may increase emotional volatility, stress, and aggression	While using, parents may sleep through infant cries/neglect child needs, may leave children alone while seeking, obtaining, or using opioids, going through withdrawal, parents may be less sensitive

(continued)

Table 28.2 (continued)

Substance	Risk factors	General effects	Parenting effects
Amphetamines	Single status, family history of alcohol/drug problems, mental health problems, other substance use, adolescent delinquency, childhood sexual abuse	Releases high levels of dopamine (enhances mood, body movement), euphoria followed by "crash" (irritable, paranoid, empty feelings), withdrawal symptoms (psychotic episodes, extreme violence)	While using, parents may not supervise infants or provide for basic needs, parental violence, aggression, and paranoia may increase risk of parent hostility and child abuse

Note. General effects refer to effects experienced by parents when using substances

protective "buffer" against the aversive impact of prenatal and postnatal substance exposure (Flykt et al., 2021). In this way, parenting may be a potential influencer of children's developmental trajectories. Thus, taken together, there is significant evidence to support that substance use may impact parenting behavior. However, exactly how substance use contributes differentially between individuals' parenting outcomes continues to be investigated.

Neural Pathways on Parenting

Converging evidence suggests that SUD damages and disrupts parents' reward and regulation systems, lessening the saliency of infant signals (Rutherford & Mayes, 2017), reducing distress tolerance, and contributing to less sensitive and harsher parenting. Indeed, for most mothers, interacting and engaging with one's infant is a rewarding and pleasurable experience that promotes mother–infant attachment, ensures optimal care for the developing infant, and motivates maternal behavior, even in the face of extreme fatigue and competing needs for attention. However, animal and human research studies suggest that mothers who experience a SUD, particularly cocaine use, may be less able to respond appropriately to their infant's cues even when not actively using the drug and may find these interactions less intrinsically rewarding or more stress-invoking. In fact, fMRI studies show that when infants are distressed (e.g., had sad faces and were crying), there is reduced maternal brain activation in regions responsible for reward, motivation, auditory processing, and cognitive control among mothers with substance use (Landi et al., 2011; Lowell et al., 2020), all of which facilitate maternal sensitivity (Williams & Johns, 2014). These results suggest that parents who use substances may be more likely to perceive children's negative affect as more intense, uncomfortable, and overwhelming as a result of these disrupted reward pathways and thus, may be more likely to respond harshly compared to other parents.

Cognitive Pathways on Parenting In addition to neural differences, SUD may have a distinct adverse effect on many of the higher-order cognitive-affective processes underlying parental sensitivity. Research suggests that deficits in inhibitory control, working memory, and set-shifting are associated with substance use may facilitate parental harshness (Bridgett et al., 2017). For example, Deater-Deckard et al. (2010) found that mothers with poorer working memory may have more difficulty problem-solving and are more likely to engage in harsh caregiving practices when responding to child oppositional behavior. Furthermore, new treatment development studies targeting executive functioning-focused strategies for mothers with SUD have demonstrated promising improvements in parenting (Hakansson et al., 2019). However, despite the notable research supporting links among substance use, parental executive functioning, and parenting, only a handful of studies to our knowledge have examined these factors together. Further research is recommended to delineate executive functioning as a possible pathway through which parental substance use may undermine adaptive parenting and contribute to the development of harsh parenting practices.

Regulatory Pathways on Parenting Deficits in emotion regulation processes may also contribute to the relationship between parental substance use and negative parenting outcomes. SUD has been linked with emotion dysregulation, or the lower ability to regulate intense negative emotions and emotional experiences adaptively and effectively (Dvorak et al., 2014). More specifically, the negative reinforcement model of addiction (Baker et al., 2004) emphasizes that individuals may use substances to cope with negative effects. Indeed, individuals with SUD tend to display poorer emotion regulation compared to nondependent individuals (Jakubczyk et al., 2018) and report that they use more substances when distressed to alleviate negative emotions (Patterson et al., 2008). In the absence of more adaptive coping strategies, parents with SUD may have more difficulty tolerating distress compared to other parents. Parenting can be very demanding and often elicits intense negative

emotions such as frustration and hostility (Deater-Deckard et al., 2012). To respond sensitively, parents are faced with the challenging task of regulating feelings of hostility and distress before attending to their child. Parents with SUD may have more difficulty regulating their emotions during parenting due to poorer emotion regulation abilities and disrupted neural reward processes. This difficulty may increase hostility and negative effect in response to infant distress and give rise to harsher, more reactive discipline practices. Although no research has comprehensively compared these processes in parents with and without substance-related impairments, current evidence supports considering deficits in emotion regulation as a possible mechanism through which SUD disrupts sensitive caregiving.

Parenting of Substance-Using Fathers

Overall, parental substance use may affect child outcomes through multiple facets of behavior, including cognitive, regulatory, and neural processes. However, this literature should be considered with an important limitation. Much of the previous literature has exclusively studied maternal substance use, ignoring the impact of father/partner substance on parenting and child outcomes. There is evidence that fathers who use substances may have a more limited role in their children's lives and provide less financial support than non-substance-using fathers (McMahon et al., 2008). Additionally, fathers who use substances are more likely to exhibit hostile-aggressive parenting (Stover, 2013), lower sensitivity and warmth (Eiden et al., 2009a), and higher levels of overreactive parenting over time (Edwards et al., 2009). Interestingly, depression seems to mediate the association between substance use and hostile-aggressive parenting and paternal sensitivity (Eiden & Leonard, 2000; Stover et al., 2012) or co-occurs with SUD and accounts for unique variance in parenting (e.g., Edwards et al., 2009), suggesting that assessment and treatment of depression may be important for improving parenting of substance-using men.

As described above, a distinct feature of paternal substance use is its association with (intimate partner violence) IPV perpetration. In addition, there is some emerging evidence that in the context of drug use, fathers who endorse IPV also report more hostile-aggressive parenting (Stover & McMahon, 2014). Indeed, there is significant evidence of the overlap of substance use, IPV, and child maltreatment (Hamby et al., 2011), with children who experience all three of these problems at greater risk for out-of-home placements, cognitive deficits, and psychosocial difficulties. Taken together, the evidence relating paternal substance use to increased IPV, hostility, and violence suggests potentially distinct effects of substance use on parenting in fathers. More research examining the effects of substance use on parenting in fathers may highlight novel treatment strategies and is strongly recommended.

Interventions Targeting Parental Substance Use

Another aspect of variability that is relevant to child outcomes associated with parental substance use is the treatment history of the substance-using parent, although this factor is rarely accounted for in investigations of child outcomes. As previously discussed, parents with SUD have a high prevalence of co-occurring negative physical health and mental health outcomes that may maintain substance use, including symptoms of anxiety and depression and post-traumatic stress disorder, as well as histories of physical or sexual abuse, relationship problems, negative support systems, family substance use problems, and lower income (Castillo-Carniglia et al., 2019; Eiden et al., 2007). Due to the significant needs identified in parents with SUD, strong recommendations have been made by policymakers, clinicians, and researchers for parent-specific, comprehensive, integrated treatment models for families (Greenfield et al., 2002). Integrated treatment programs focus on holistic and interdisciplinary interventions to target a range of conditions, including substance use and mental health concerns, and are associated with increased positive outcomes when compared

to the treatment of individual disorders alone (Kelly & Daley, 2013).

Within this integrated treatment framework, parenthood has emerged as an important avenue for intervention. Indeed, studies have found that gender-focused treatment components that emphasize motherhood and aim to increase mothers' understanding of their own and their child's thoughts and feelings are the most effective treatment for substance-using women with children (Moreland & McRae-Clark, 2018). Converging evidence suggests that increasing mothers' positive interactions and decreasing stress responses in parenting could prevent relapse (Rutherford et al., 2011). Taken together, strong evidence suggests that parenting/family interventions are important components in the treatment of parental substance use. Nevertheless, there is wide variation in the type, length, and outcomes of parenting interventions in substance use treatment, making it unclear which pathways to substance use cessation are impacted by parenting (Moreland & McRae-Clark, 2018). Given the unique needs of substance-using parents, it is critical to make specific adaptations to evidence-based parenting interventions for use with this population. Because some programs have been specifically developed and adapted for women in substance use treatment, it is essential to further evaluate the use of these interventions so that they can be widely disseminated.

Interventions for Paternal Substance Use

Despite evidence that fathers with substance use problems would benefit from interventions to improve their parenting, there have been limited studies on the effectiveness of integrating parenting skills for men in substance use treatment. Several studies have indicated that fathers with substance use problems report lower fatherhood satisfaction, higher feelings of guilt about their parenting, and concern about the kind of role model that they have been for their children (McMahon et al., 2008; Rubenstein & Stover, 2016). A survey of fathers in residential SUD treatment found that 95% of the fathers said that they thought about their children all the time, 70% agreed that it would be helpful as a part of their treatment to discuss parenting and father–child issues, and 77% indicated that they would be interested in fatherhood and co-parenting centered sessions as a part of their residential treatment (Rubenstein & Stover, 2016). Preliminary evidence from a small pilot study demonstrated significant reductions in substance use and improvements in parenting satisfaction in men who received fatherhood-focused intervention compared to those who received regular treatment (Stover et al., 2018). Along similar lines, an ongoing prevention-focused randomized clinical trial (NCT04441307), Strong Family Foundations (SFF), based on the Family Foundations intervention (FF; Feinberg & Kan, 2008), is attempting to address the need for father-focused substance intervention. SFF is based on two key findings from the Buffalo Longitudinal Study beginning in infancy: (1) the protective role of parental sensitivity in preventing the cascade of risk processes and fathers' depression in infancy on adolescent substance use (Eiden et al., 2016) and (2) Results from analyses examining differences between resilient versus vulnerable children highlight three major sets of constructs: (a) level of fathers drinking and alcohol problems, (b) couple relationship quality, and (c) fathers' stress and depression (Eiden et al., 2020a). More positive couple relations, lower levels of father problematic drinking, and lower levels of fathers' stress and depression contributed to children's resiliency. Other analyses indicated that the spillover of interparental relations into the quality of parent–child interactions in early childhood contributed to child outcomes at school age. Viewed in the context of the larger developmental literature on the long-lasting impact of parental sensitivity in early childhood (Raby et al., 2015) and the developmental cascade model of adolescent substance use (Dodge et al., 2009; Eiden et al., 2016), these findings had the following implications for prevention: (1) intervention is needed to reduce fathers' drinking and alcohol-related symptoms; (2) early intervention is needed to prevent the cascade of risks associated with fathers' alcohol problems; and (3) intervention should enhance the couple relationship and

parental adjustment, thereby promoting positive parenting and child adjustment. Targeting fathers' drinking at a time when there is greater discordance among couple drinking patterns (i.e., during pregnancy) also has the potential to impact mothers' ability to maintain abstinence during pregnancy, thereby reducing fetal alcohol effects. Thus, the major goal of this preventive intervention is to examine the efficacy of an SFF intervention including alcohol content and behavior intervention in reducing fathers' heavy drinking and enhancing couple dyadic functioning and parent adjustment, thereby promoting parenting warmth/sensitivity and promoting positive child outcomes. Given the important benefits of parenting interventions for maternal substance use, integrating fatherhood into substance use treatment merits further investigation.

Conclusion

Although parental substance use has deleterious effects on developmental outcomes, there is significant heterogeneity based on the type of substance, timing, dose, and chronicity of use. From a developmental psychopathology framework, characteristics of substance exposure as well as a number of other moderating factors, such as genetic and epigenetic variations, parental history of early adversity, sociodemographic characteristics, and symptoms of psychological distress, may explain the equifinality and multifinality of developmental outcomes observed both between and across substances. To capture this nuance, prospective longitudinal studies with large or multisite samples including fathers, multiple methods of assessing substance use, and careful measurement of co-occurring risk factors are necessary.

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